Application No.:	C.12-08-015; C.13-11-002
Exhibit No.:	SCE-01
Witnesses:	Jennifer Kamphuis
	Vishal Patel
	Erin Pulgar

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(U 338-E)

REPLY TESTIMONY ON PHASE I ISSUES

Before the

Public Utilities Commission of the State of California

Rosemead, California
August 4, 2014

SCE-01: REPLY TESTIMONY ON PHASE I ISSUES

Table Of Contents

SCE-01: REPLY TESTIMONY ON PHASE I ISSUES

Table Of Contents (Continued)

I.

INTRODUCTION

This reply testimony responds to the issues presented in testimony by Edward Soler Jr., David Davis, Daniel Davis, as well as issues identified in the May 28, 2014 *Assigned Commissioner's and Administrative Law Judge's Scoping Memo and Ruling* ("Scoping Ruling"). Specifically, this reply testimony addresses the following Phase 1 issues:[1]

1. Must a generating facility be sized no greater than its associated premises' annual load to receive CSI incentives?
2. Can the annual estimated generation for purposes of NEM generating facility size requirements be calculated using the manufacturer's inverter efficiency rate for situations involving high panel to inverter ratios?
3. Can a load justification be required for a proposed NEM generating facility if the system is smaller than 5 kW?
4. If Davis installs solar panels at properties he rents to tenants, resulting in electricity used not by Davis but by his tenants, does the installation still "offset customer's own electrical requirements" such that the project can qualify for NEM under § 2827(b)(4)?
5. If Davis installs a solar PV system at his home and allows non-residents to use the electricity generated by this PV system, does that use count as part of "customer's own electrical requirements" for purposes of NEM eligibility?

[1] *See* Scoping Ruling, at pp. 12-13; July 1, 2014 ALJ Email Ruling ("Parties are instructed to include evidence related to [Issue Nos. 1, 2 and 3] in their written testimony. . . In their testimony, parties should clearly explain the facts of the case necessary to support the arguments they intend to make in their briefs. . . . Parties are not required to file additional legal briefs on the 3 legal issues, but parties may elect to address the legal issues again in briefs filed after the evidentiary hearing").

6. Are any safety considerations raised by determination of whether a proposed solar PV system qualifies under NEM, CSI, or NSC? Are there any other safety considerations raised by these consolidated proceedings?

II.

A GENERATING FACILITY CANNOT BE SIZED GREATER THAN ITS ASSOCIATED PREMISES' ANNUAL LOAD TO RECEIVE CSI INCENTIVES

Through 2006, the California Public Utilities Commission's (the "CPUC" or the "Commission") Self-Generation Incentive Program ("SGIP") provided incentive payments to customers who installed distributed generation systems, including solar facilities. In Rulemaking (R.)04-03-017, the Commission stated its intent to fund a new distributed generation program specific to solar, namely the California Solar Initiative ("CSI"), and, in Decision (D.)06-01-024, the Commission committed $2.5 billion to CSI over 10 years.

The CSI program is overseen by the CPUC and administered by investor owned utilities. SCE has been a Program Administrator for the CSI program since the beginning of the program in 2007. SCE is responsible for processing applications, and understands applications must be processed in accordance with the requirements set forth in the relevant statutes, CPUC decisions, and the CSI Handbook. SCE is also obligated to administer the CSI program in a fair, non-discriminatory manner.

Under Section 25782 of the California Public Resources Code, a solar energy system must be "intended primarily to offset part of or all of the consumer's own electricity demand" to be eligible for CSI incentives.

Since the inception of the CSI program, the Commission has addressed system sizing multiple times. Section 2.2.4 of the CSI Program Handbook states:

> To be eligible for CSI Incentives, the system must be sized so that the amount of electricity produced by the system primarily offsets part or all of the Host Customer's electrical needs at the Project Site. Unless additional load substantiation documentation is submitted, the estimated annual kWh production of the proposed system as shown on the EPBB calculator may not be higher than the previous 12-month energy usage.

Additionally, section 2.2.5 of the CSI Program Handbook states:

> In accordance with Senate Bill 1 (2006), no solar energy systems that exceed a customer's onsite load will receive a CSI incentive.

SCE understands that the CSI Program Handbook is consistent with Commission Decision 06-07-028, where the Commission expressly held that "the maximum solar system size eligible for incentives under the … California Solar Initiative (CSI) … [is] 100% of historical annual usage, based on customer usage data from the previous 12 months." (D.06-07-028, at Ordering Paragraph No. 1; *see also id.* at Conclusions of Law Paragraph No. 2 ("System size eligibility requirements for solar facilities should be modified from 100% of peak load to 100% of annual historical usage, based on the previous 12 months customer usage.").

SCE has applied the system sizing requirement using the methodology described above to approximately 57,000 applications, including Mr. Davis's applications.

III.

ANNUAL ESTIMATED GENERATION MUST BE CALCULATED USING STANDARDIZED INVERTER EFFICIENCY RATES PUBLISHED BY THE CEC

A. SCE Has Properly Applied Its NEM Estimation Formulas

A photovoltaic generating facility includes, among other key components, an array of solar panels and an inverter.[2] The solar panels convert solar energy into to Direct Current ("DC") electrical energy. The inverter converts the DC electrical energy to Alternating Current ("AC") electrical energy, which can then be exported to SCE's AC electrical energy distribution system.[3] During the course of converting DC power to AC power, some power is lost. For example, in this conversion some energy is lost to heat and some energy is lost because it is used to power the inverter. An inverter's efficiency reflects how much DC power is actually converted to AC power, taking into account these losses.

To be eligible for SCE's NEM tariff, a customer's Renewable Electrical Generating Facility must be "intended primarily to offset part or all of the Customer's own electrical requirements."[4] In order to determine whether a proposed facility offsets the Customer's electrical requirements, the estimated generation of the proposed facility must be calculated. To do so, SCE must evaluate certain features of the proposed facility, including the number of solar panels, the model of the solar panels, and the model of the inverter. SCE utilizes one of two formulas to calculate the estimated monthly kilowatt-hour ("kWh") output. Both formulas applied by SCE rely upon, among other variables, an "Inverter Efficiency %" variable, which reflects the anticipated DC-to-AC losses of the particular model of inverter chosen by the applicant. For California Energy Commission (CEC) certified inverters—such as the inverters

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[2] Other key components include, among others, cables, disconnects, and connectors.

[3] The amount of export to SCE would depend on the specifics of the situation, taking into account any load "behind the meter" on an NEM type service.

[4] SCE's Tariff Schedule NEM at Sheet 13.

serving Mr. Davis's currently interconnected generating facilities—SCE determines the "Inverter Efficiency %" variable based upon manufacturer data published by the CEC.

The opening testimonies of David Davis and Daniel Davis request that the Commission prospectively adopt a new formula for estimating the future kWh generation of a photovoltaic generating facility.

1. NEM Handbook Formulas

To determine whether a customer's Renewable Electrical Generating Facility is "intended primarily to offset part or all of the Customer's own electrical requirements," SCE understands that the estimated future generation of the proposed generating facility should be determined.[5]

SCE's NEM Interconnection Handbook ("NEM Handbook") "specifies the typical minimum technical requirements to interconnect generating facilities with SCE's electric system under the Net Energy Metering (NEM) program" to process NEM applications.[6] Under the procedures established in the NEM Handbook, estimated monthly kWh output is calculated by using either one of two formulas:[7]

a. Formula No. 1: (CEC-AC Nameplate) x 720 x 0.2 = ____ kWh; or

b. Formula No. 2: The CSI EPBB calculator located at www.csi-epbb.com.

Both of these formulas, in turn, rely, in part, on an inverter efficiency variable.

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[5] SCE does not address analysis relating to the actual or reasonably anticipated annual load calculation in this testimony because it is beyond the scope of the Phase 1 issues. In addition, SCE acknowledges that, pursuant to the Scoping Ruling, "the scope of Phase 1 of these consolidated proceedings will not address whether "electrical requirements" under Section 2827(b)(4) should be interpreted to limit size based on customer peak demand or annual load."

[6] *See* NEM Handbook, Version 5.0 at p. 5. Please see Section IV for additional testimony relating to the NEM Handbook. The NEM Handbook is also attached to this testimony as Appendix B.

[7] *See* NEM Handbook, Version 5.0 at p. 7.

a) Formula No. 1

For Formula No. 1, (CEC-AC Nameplate) x 720 x 0.2 = ____ kWh, SCE must calculate the CEC-AC Nameplate.[8] The CEC-AC Nameplate represents the anticipated amount of AC power that the proposed generating facility can contribute to the distribution system when taking into account the number of solar panels, the particular model of solar panel and the particular model of inverter. Under the NEM Handbook, variable "(CEC-AC Nameplate)" is determined pursuant to the following calculation:

(Quantity of Modules) x (PTC Rating) x (Inverter Efficiency %) / 1000 = ____ kW

The "Quantity of Modules" refers to the proposed generating facility's number of PV solar panels. "PTC Rating" represents the estimated power output in Watts for a particular model of solar panel under specific test conditions.[9] It is a standardized estimate calculated by the CEC using laboratory-tested parameter values.[10]

The "Inverter Efficiency %" reflects anticipated power losses that occur when an inverter converts DC to AC. During the course of converting DC power to AC power, some power is lost due to heat and other factors. An inverter's efficiency reflects how much DC power is actually converted to AC power. Section 2.2 of the NEM Handbook states that for CEC-certified

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[8] 720 represents the number of hours in a month. .2 represents the average number of full sun hours in a 24 hour period in Southern California. SCE notes that Pacific Gas and Electric Company ("PG&E") uses a similar formula: (CEC-AC rating) x 8,760 hrs/yr x .19 = ___ kWh. *See* AGREEMENT AND CUSTOMER AUTHORIZATION, Net Energy Metering Interconnection For Solar And/Or Wind Electric Generating Facilities Of 30 Kilowatts Or Less (Form 79-1151A, Advice 4369-E). PG&E's formula calculates the number of hours in a year, as opposed to the number of hours in a month.

[9] "PTC" is an acronym for PVUSA Test Conditions. This is a standardized set of testing conditions that are used to evaluate the performance of a particular model of solar panel.

[10] This published data can be found at the "Go Solar California!" website, at http://www.gosolarcalifornia.ca.gov/equipment/pv_modules.php (last visited August 1, 2014). The modules are also required to have an ANSI/UL1703 safety certification issued by a Nationally Recognized Testing Laboratory (NRTL).

equipment, an applicant must list inverter technical information consistent with the test data maintained and published by the CEC. This CEC data reflects a weighted average of the inverter efficiency for a particular model of inverter. This weighted average reflects a particular model's performance during different standardized measurements tested by a Nationally Recognized Testing Laboratory (NRTL). Such measurements include testing at different: input voltage, input current, input power, output voltage, output power, ambient temperature and inverter temperature at heat sink.[11] The published CEC data identifies a specific "Inverter Efficiency %" for each model of inverter that is approved by the CEC.[12]

b) Formula No. 2

For Formula No. 2, the CSI EPBB calculator, estimated generation is determined by multiplying the "CEC-AC System Rating" by the "Design Factor." The "CEC-AC System Rating" variable is the same as the "(CEC-AC Nameplate)":

(Quantity of Modules) x (PTC Rating) x (Inverter Efficiency %) / 1000 = ____ kW|

This variable is calculated using the same methodology discussed above. As above, SCE relies on CEC data to determine the inverter efficiency % variable.

The "Design Factor" determines the estimated performance of a proposed system, when taking into account the proposed physical location and the specific configuration of the generating facility. The "Design Factor" is calculated by the National Renewable Energy Laboratory's ("NREL")[13] PV Watts version 2 ("PV Watts") software program, which is run after

[11] *See* Performance Test Protocol for Evaluating Inverters Used in Grid-Connected Photovoltaic Systems, Section 5.4.1 at p. 14, *available at* http://www.gosolarcalifornia.ca.gov/equipment/inverters.php (last visited Aug. 1, 2014)

[12] This published data can be found at http://www.gosolarcalifornia.ca.gov/equipment/inverters.php (last visited Aug. 1, 2014).

[13] NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

a user inputs data specific to the proposed system and proposed location (*e.g.*: zip code; model of solar panel; number of solar panels; tilt of the solar panels; azimuth of the solar panels; etc.).

Thus, as described in this section, SCE's NEM Handbook establishes that two formulas can be used to determine estimated kWh generation of a proposed photovoltaic generating facility. Both provide a uniform, nondiscriminatory way to efficiently process thousands of NEM applications.

2. Mr. Davis's Currently Interconnected Generating Facilities

Mr. Davis's Second Amended Complaint requests that the Commission provide the following:

- "with respect to 61736 Onaga, allow me NEM interconnection for an additional 30 horizontal panels on each of the two existing, already interconnected non-CSI 6kW inverters and an additional 30 horizontal and 30 vertical panels on the existing 6kW CSI inverter . . . additionally, to the extent that any estimate of anticipated production might be required, that that estimate be adjusted for reduced inverter efficiency caused by the high panel to inverter ratio (total three 6kw inverters with 60 horizontal panels each and an additional 30 vertical panels on one);
- with respect to 65911 29 Palms Hwy apartments 1-8, allow me NEM interconnection for an additional 30 panels on each of the existing, 5kW, already interconnected CSI inverters . . . additionally, to the extent that any estimate of anticipated production might be required, that that estimate be adjusted for reduced inverter efficiency caused by the high panel to inverter ratio (total 1 5kW inverter with 60 panels per apartment);[14]

Each of the interconnected generating facilities at the nine referenced locations is currently producing sufficient electricity to offset the load of the location:

[14] Second Amended Complaint, at pp. 41-42.

Table III-1

Location of Generating Facility	**Permission to Operate (PTO) Date**	**Previous Relevant Period[15]**	**Previous Relevant Period Net Energy Usage[16] (kWh)**	**Current Relevant Period**	**Current Relevant Period Net Energy Usage (kWh)**
61736 Onaga Trail	a. 12-28-2011 (for 5.996 kW NEM Generating Facility) b. 04/18/2013(for expanded 17.3 kW Generating Facility)	12-24-2012 to 12-23-2013	-1413	12-23-2013 to 07-25-2014	-7584
65911 TwentyNine Palms Hwy #5	08-28-2012	08-28-2012 to 09-18-2013	-9599	09-18-2013 to 07-22-2014	-7601
65911 TwentyNine Palms Hwy #6	08-28-2012	08-28-2012 to 09-18-2013	-7926	09-18-2013 to 07-22-2014	-6073
65911 TwentyNine Palms Hwy #1	05-20-2013	05-20-2013 to 05-19-2014	1345	05-21-2014 to 07-22-2014	-1230
65911 TwentyNine Palms Hwy #4	08-01-2013	08-01-2013 to 7-22-2014	-4785	n/a[17]	0
65911 TwentyNine Palms Hwy #8	08-01-2013	08-01-2013 to 7-22-2014	-4740	n/a[18]	0
65911 TwentyNine Palms Hwy #2	12-11-2013	n/a[19]		12-11-2013 to 07-22-2014	-3888

15 SCE's Schedule NEM defines Relevant Period as: "A twelve-month period, or portion thereof, commencing on the anniversary Date of Final Interconnection of the customer's generator to SCE's electric system and on every subsequent anniversary thereof."

16 A negative number indicates that the generating facility is generating net surplus kWh.

17 The "n/a" reflects that the prior Relevant Period just completed and no data is yet available for the current Relevant Period.

18 The "n/a" reflects that the prior Relevant Period just completed and no data is yet available for the current Relevant Period.

19 The "n/a" reflects that this meter has not yet completed a full Relevant Period.

65911 TwentyNine Palms Hwy #3	12-11-2013	n/a[20]		12-11-2013 to 07-22-2014	-2732
65911 TwentyNine Palms Hwy #7	12-11-2013	n/a[21]		12-11-2013 to 07-22-2014	-3824

Each location that states negative energy usage demonstrates that the generating facility is currently producing net surplus kWh.

3. Flaws Relating to Daniel Davis Analysis of Inverter Efficiency %

The testimony of Daniel Davis reflects a flawed critique of the "Inverter Efficiency %" variable as it is used in Formula No. 1. Daniel Davis incorrectly alters this variable, changing it from inverter efficiency to system efficiency. Daniel Davis's testimony states the following:

> Mr. Davis's generators consist of 60 Schott 230 Poly solar modules which have a PTC rating of 207.7 connected to an SB5000-US inverter which can convert a maximum of 5.1kW from DC to AC. First we calculate the "Inverter Efficiency %" using formula (11):
>
> Inverter Efficiency % = 5100 / (60 x 207.7) x 100 -= 40.924%.[22]

Daniel Davis is stating that Inverter Efficiency is calculated based upon: (1) a presumed maximum AC output for an inverter (i.e. 5100 W), which is then (2) divided by the maximum DC output of an attached set of solar panels (number of panels times the PTC rating of those panels, i.e. 60 panels x. 207.7 W = 12,462 W).

This is not inverter efficiency. Rather, Daniel Davis is describing system efficiency. Specifically, he is describing the system efficiency of the total generating facility for a single hypothetical configuration. Assuming the AC output and DC output values used by Daniel Davis are correct, the hypothetical system efficiency described by Daniel Davis is approximately 40.9 percent. But this is not the inverter efficiency ratio, which is a different variable that

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[20] The "n/a" reflects that this meter has not yet completed a full Relevant Period.

[21] The "n/a" reflects that this meter has not yet completed a full Relevant Period.

[22] Daniel Davis testimony, at p. 11.

considers only the amount of power due to the conversion of power from DC power to AC power.

Daniel Davis's testimony incorrectly presumes the full DC output generated by the 60 panels is processed by the inverter. It is not. The Testimony of Edward Soler, Jr. attached a "PV Inverter Sunny Boy Installation Manual," which Mr. Soler asserts is the "manufacturer's data sheets for the SMA SB5000-US inverter."[23] If it is assumed that this is the user manual for Mr. Davis's 5 kW inverter, then the Technical Data sheet within that manual states that the maximum DC power processed by Mr. Davis's inverter is 5300 W.[24] Accordingly, any additional watts beyond the 5300 W is not processed by the inverter, in order to manage the AC output to its targeted 5000 W. The inverter efficiency is not reduced in the manner Daniel Davis describes.

Daniel Davis's formula is also flawed because it relies on the PTC rating for the wrong solar panel. It assumes the use of Schott 230 solar modules.[25] However, David Davis's interconnected generating facilities utilize Schott Poly 225 solar modules.

In addition, both the David Davis and Daniel Davis testimonies fail to address the applicability of the NEM Handbook Formula No. 2, or the appropriate input for the "Inverter Efficiency %" under that formula, which takes into account a more specialized consideration of the location and configuration of the proposed facility.[26]

4. Davis Is Seeking a Policy Change

The David Davis and Daniel Davis testimonies do not demonstrate that SCE has incorrectly applied the "Inverter Efficiency %" variable in the two NEM Handbook formulas. Rather, their testimony asks that the Commission adopt new, alternative

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[23] Soler testimony, at p. 1.

[24] Soler testimony, at Attachment, p. 91.

[25] Daniel Davis testimony, at p. 11.

[26] SCE acknowledges that the NEM Formula No. 2 is likely to return an "error message" for Daniel Davis's hypothetical system because it is configured to cause the CEC-AC System Rating to exceed the inverter's rating by greater than 125 percent.

formulas/methodologies. Both David Davis and Daniel Davis propose to use the inverter manufacturer's (SMA America) Sunny Design tool. This Sunny Design tool is web-based software published on the inverter manufacturer's website. SCE believes it is inappropriate to rely upon individual inverter manufacturer software. SCE relies upon standardized formulas, using inputs set by the CEC that can be used to efficiently process thousands of NEM applications in a uniform and nondiscriminatory way.

Daniel Davis also proposes to use the NREL System Advisor Model (SAM).[27] While the NREL SAM may be a reasonable methodology to use to estimate generation, in developing policies and procedures for processing NEM applications, SCE elected to use the above described two NEM Handbook Formulas. These formulas are published in the NEM Handbook, which has been used to process thousands of NEM interconnections since 2011, as discussed in Section IV of this testimony. Daniel Davis is asking to permit Mr. Davis to rely upon an alternative methodology that is different from the standard processes that SCE has applied to thousands of other NEM applicants.

Mr. Davis's hypothetical system configuration (i.e. 60 solar panels per 5 kW or 6 kW inverter) is unusual. The vast majority of applications processed by SCE do not contain this type of high panel-to-inverter ratio. In fact, the NEM Formula No. 2 (i.e. the CSI EPBB calculator), would return an "error message" for the hypothetical system proposed by Mr. Davis.[28] Although the NEM Formula No. 1 does not have a built-in "error message" that prevents calculation of such overloading, it is not designed to address such substantial overloading beyond the rating of an inverter.

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[27] Daniel Davis testimony, at p. 14.

[28] The CSI Calculator User Guide version 5 ("CSI Calculator User Guide"), which outlines NEM Handbook Formula No. 2 states: "if the CEC-AC rating of the proposed system is greater than 125 percent of the inverter rating, an error is flagged which must be corrected (by reducing the number of panels, choosing a lower PTC rated panel, increasing the number of inverters or choosing a larger capacity inverter) before being allowed to proceed to the results page." *See* CSI Calculator User Guide, at p. 5, *available at* http://www.csi-epbb.com/CSICalculatorV4UserGuide.pdf

Indeed, according to Mr. Davis himself, his hypothetical system is extremely inefficient. Even assuming his testimony is correct, Mr. Davis concedes that the overall efficiency of the system he proposes would only output 40.9 percent of the DC power produced by the solar panels. If Mr. Davis did not "overload" the inverters with such a large number of panels, the proposed facility would not waste as much energy. However, Mr. Davis's proposed "overloading" of the Sunny Boy inverters located at the properties described in Section IV.A.2 remains hypothetical.

IV.

SCE MAY REQUIRE LOAD JUSTIFICATION FOR A PROPOSED NEM GENERATING FACILITY EVEN IF THE SYSTEM IS SIZED SMALLER THAN 5 KW

SCE may require load justification for a proposed NEM generating facility even if the system is sized smaller than 5 kW. To be eligible for NEM, a proposed generation facility must be intended primarily to offset part of all of the customer's own electrical requirements. SCE understands that it is obligated to ensure that NEM customers satisfy the sizing requirements applicable to all eligible customer-generators, regardless of system size, as set forth in SCE's NEM Tariff, SCE's NEM Application, and SCE's NEM Handbook.

SCE NEM Tariff. SCE's NEM tariff is only applicable to Eligible Customer-Generators, as the term is defined in both Public Utilities Code Section 2827(b)(4)(A) and Special Condition 6.a of SCE's Tariff Schedule NEM ("Schedule NEM"). One of the requirements for *all* Eligible Customer-Generators is that the customer's Renewable Electrical Generating Facility be "intended primarily to offset part or all of the Customer's own electrical requirements."[29] Further, Special Condition 6.f of Schedule NEM, which addresses generator size, states that:

> Nothing in this Special Condition alters the existing NEM system sizing requirements and limitations. To be eligible for NSC, a system must meet the definition of an eligible customer-generator within Section 2827(b)(4), including that it be intended primarily to offset part or all of the customer's own electrical requirements. Systems that are sized larger than the customer's electrical requirements are not eligible for NEM and therefore, are not eligible for NSC."[30]

Nowhere in the NEM tariff is there a differentiation or distinction made in regards to the NEM sizing requirements based on whether a system is sized smaller or larger than 5 kW. Because *all* proposed NEM generating facilities must be sized to offset the customer's own electrical requirements, SCE believes that it is allowed to request information from *any* Eligible Customer-

[29] SCE's Tariff Schedule NEM at Sheet 13.

[30] *Id.* at Sheet 14.

Generator, regardless of the size of the proposed generating facility, to help ensure compliance with its CPUC-approved tariffs and statutory requirements.

SCE NEM Application. All Eligible Customer-Generators seeking to interconnect a Renewable Electrical Generating facility to SCE's electric system must first complete an application for interconnection. SCE's Form 14-753, *Application for Net Energy Metering of a New Solar, Wind or Fuel Cell Generating Facility of Not More Than 10kW Under NEM Rate Schedule*, is the applicable interconnection application for most generating facilities sized 10 kW and smaller[31] – which necessarily encompasses systems that are sized smaller than 5 kW. The Applicability section of this application informs Eligible Customer-Generators that their generating facilities must operate in parallel with SCE's electric system "for the purpose of offsetting part or all of the eligible customer-generator's own electrical requirements." The last section of this application, captioned "Qualified NEM Generating Facility," requires all Eligible Customer-Generators to provide information so that SCE can calculate the estimated monthly kWh production of the generating facility. Nowhere in the NEM Application is there a differentiation or distinction made in regards to the NEM sizing requirements based on whether a system is sized smaller or larger than 5 kW.

SCE NEM Handbook. Further, SCE publishes the NEM Handbook (included herein as Appendix B) to specify the minimum requirements necessary to interconnect a generating facility to SCE's electrical system. SCE first published the Handbook in October 2011 to help answer technical questions from customers and contractors in regards to interconnecting generating facilities pursuant to the NEM tariff. Over 60,000 NEM interconnections have been completed since SCE first began referring customers to the NEM Handbook. Although not officially filed with the Commission, SCE makes the NEM Handbook publically available on the internet, at https://www.sce.com/NR/sc3/tm2/pdf/ce158-12.pdf. SCE applies the requirements

[31] Generating facilities that include paired energy storage systems, for example, must complete the longer interconnection application, Form 14-732, regardless of system size.

of the NEM Handbook to all NEM Eligible Customer-Generators to help ensure fair, non-discriminatory and equal access to the NEM program.

Tables 2.2-2 and 2.2-4 of the NEM Handbook outline the standard formulas used to calculate the CEC-AC nameplate system size (kW) and estimated monthly kWh output for solar PV generating facilities applying under the NEM program.[32] This information is used by SCE to help ensure that the proposed generating facility is sized to offset the customer's own electrical requirements. Nowhere in the NEM Handbook is there a differentiation or distinction made in regards to the NEM sizing requirements based on whether a system is sized smaller or larger than 5 kW.

Because all Eligible Customer-Generators must comply with the requirement that their proposed generating facilities be sized to offset part or all of their own electrical requirements, SCE understands that it may request load justification from any Eligible Customer-Generator to help ensure compliance with this requirement, regardless of the size of the proposed generating facility.

[32] NEM Handbook, Version 5.0 at p. 7.

V.

IF DAVIS INSTALLS SOLAR PANELS AT PROPERTIES HE RENTS TO TENANTS, RESULTING IN ELECTRICITY USED NOT BY DAVIS BUT BY HIS TENANTS THE INSTALLATION MAY STILL "OFFSET CUSTOMER'S OWN ELECTRICAL REQUIREMENTS" SUCH THAT THE PROJECT CAN QUALIFY FOR NEM UNDER 2827(B)(4)

SCE's Tariff Rule 1 defines "Customer" as "the person in whose name service is rendered as evidenced by the signature on the application, contract or agreement for that service, or, in the absence of a signed instrument, by the receipt and payment of bills or Summary Bills regularly issued in his name regardless of the identity of the actual user of the service."[33] Mr. Davis is the customer of record for the Service Accounts associated with each of the locations identified in the March 24, 2014 revised Joint Prehearing Conference Statement:[34]

- 60215 Alta Loma Apt. A
- 60215 Alta Loma Apt. B
- 60219 Alta Loma Apt A
- 60219 Alta Loma, Apt B
- 65911 Twentynine Palms Hwy Apt 1
- 65911 Twentynine Palms Hwy #2
- 65911 Twentynine Palms Hwy #3
- 65911 Twentynine Palms Hwy #4
- 65911 Twentynine Palms Hwy #5
- 65911 Twentynine Palms Hwy #6
- 65911 Twentynine Palms Hwy #7

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[33] SCE's Tariff Rule 1, *Definitions*, at Sheet 3.

[34] Mr. Davis is also the customer on the NEM Interconnection Agreements for these locations that were entered into with SCE.

- 65911 TwentyNine Palms Hwy #8
- 6804 Park Blvd
- 6804 Park Blvd #1
- 6804 Park Blvd #2
- 6804 Park Blvd #3
- 6804 Park Blvd #4
- 6807 Park Blvd.
- 6815 Park Blvd
- 61736 Onaga Trail

Pursuant to Rule 1, regardless of the actual user of the service, the load registered on the applicable meters is considered Mr. Davis's responsibility since service is rendered in his name. Therefore, SCE believes that it appropriately allowed Mr. Davis to use the load registered on the meters that are in his name, for which he is financially responsible, as his own electrical requirements for the purposes of participating in the NEM program, which is consistent with how SCE applies these requirements to its other customers.[35]

SCE's Tariff Rule 18, *Supply to Separate Premises and Use By Others*, governs how Mr. Davis is to charge his tenants for the electricity that is registered on meters that are in his name. Specifically, Rule 18, Section E.2 states, in part, that "A customer shall not charge for electricity received from SCE and used by another person, except:...Where the charge to *domestic* or nondomestic *tenants* is absorbed in the rental for the Premises or space occupied, is not separately identified, and does not vary with electrical usage…" (Emphasis added).[36] All customers to whom this requirement is applicable, including Mr. Davis, are required under SCE's tariffs to comply with this provision.

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[35] Mr. Davis also entered into the NEM Interconnection Agreement with SCE for the Renewable Electrical Generating Facilities associated with these accounts, and is therefore considered the NEM Eligible Customer-Generator for these accounts.

[36] SCE's Tariff Rule 18, *Supply to Separate Premises and Use By Others*, at Sheet 1.

However, this assumes that the load registered on the meters to which the Renewable Electrical Generating Facilities are interconnected meet the applicability requirements for the rate under which those services are billed. The accounts listed above are all served under SCE's Schedule D – Domestic Service. Schedule D is applicable to "domestic service including lighting, heating, cooking, and power or combination thereof in a Single-Family Accommodation or an individually metered Single-Family Dwelling in a Multifamily Accommodation." Based on SCE's understanding of the characteristics of the accounts listed above, the usage on those meters meet the applicability requirements for receiving Domestic Service and are appropriately served under Schedule D.[37] Schedule NEM can then be applied as a rider to the accounts' otherwise applicable rate schedules (i.e., Schedule D), and the load registered on those accounts is appropriately considered the customer of record's (i.e., Mr. Davis) own electrical requirements for the purposes of participating in NEM.

[37] SCE notes that Schedule D does not contain Demand Charges. Under Schedule D, customers are responsible for $/kWh energy charges based on a tiered rate structure and a Basic or Minimum Charge. For instance, the Basic Charge for a Multifamily Accommodation is $0.024/meter/day (or $0.72/meter/month based on a 30-day billing period).

VI.

IF DAVIS INSTALLS A SOLAR PV SYSTEM AT HIS HOME AND ALLOWS NON-RESIDENTS TO USE THE ELECTRICITY GENERATED BY THIS PV SYSTEM, THAT USE MAY COUNT AS PART OF "CUSTOMER'S OWN ELECTRICAL REQUIREMENTS" FOR PURPOSES OF NEM ELIGIBILITY

For the purpose of this response, SCE answers assuming that Mr. Davis intends to allow non-residential third-party electric vehicle (EV) charging usage to register on his home's Domestic Service meter, to which a Renewable Electrical Generating Facility would be installed under Schedule NEM to help offset the costs of EV charging.[38]

As a threshold matter, Mr. Davis can power his EV charger in a variety of ways. For example, he can supply power to it from an isolated generating facility (i.e., neither the generating facility nor the fast charger will operate in parallel with SCE's distribution system). Alternatively, Mr. Davis can elect to utilize the fast charger by receiving service from SCE's distribution system under an appropriate electric vehicle tariff.

If Mr. Davis elects to receive service from SCE's distribution system, he can then elect to offset that electric vehicle load via a generating facility in one of two ways. First, he can supply power to the EV charger from an isolated generating facility, and install an Automatic Transfer Switch that would allow him to power his EV charger with electricity from the grid when his generating facility is unavailable for use. Alternatively, he could also apply to interconnect that generating facility to SCE's distribution system.

If Mr. Davis interconnects his proposed facility to SCE's distribution system, he can then enroll in the NEM program provided his interconnection meets all requirements of the NEM tariff. As outlined in the response to Question VI above, SCE understands that any load that

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[38] Mr. Davis has submitted one Rule 21 Application to install a 95 kW solar generating facility at 61736 Onaga, Joshua Tree, CA 92252, which Complainant represented was intended to serve an electric vehicle charger. SCE has no record regarding any additional applications for interconnection of NEM-eligible generating facilities by Mr. Davis to serve load of other, unspecified EVchargers.

registers on a specific meter is considered the responsibility of the customer in whose name service is rendered, regardless of the actual user of the electricity. For NEM purposes, SCE considers any load that registers on the meter to which the Renewable Electrical Generating Facility is interconnected to be the "customer's own electrical requirements." Because Mr. Davis is the customer of record for the Service Account associated with the meter located at his residence at 62736 Onaga, SCE would consider the load registered on Mr. Davis's meter as Mr. Davis's "own electrical requirements," regardless of whether he allows non-residents to use the electricity generated by his facility.

But this assumes that the registered load meets the applicability requirements for the otherwise applicable rate schedule (e.g., Schedule D) under which service is rendered. Schedule NEM is not a standalone tariff. SCE applies Schedule NEM as a rider tariff to the customer's otherwise applicable rate schedule to allow for the monthly netting of energy consumed with energy exported to the grid over a 12-month Relevant Period.[39] Schedule NEM does not alter the underlying applicability requirements for the otherwise applicable rate schedule under which a customer is appropriately served.

Mr. Davis has represented to SCE that he desires to oversize his NEM generating facility(ies) to avoid paying Demand Charges that may be caused by the installation and use of a 50 kW EV fast charger.[40] However, Mr. Davis would only be responsible for Demand Charges to the extent that his EV charging load must be served on an otherwise applicable rate schedule that contains Demand Charges. Currently, EV fast chargers that are both (a) installed at residential Single-Family Accommodation locations and (b) used for residential purposes, are

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[39] Schedule NEM does not allow for the netting of demand (kW) charges; only energy (kWh) charges and credits are netted. A customer that installs a generating facility may see a reduction in Demand Charges because of the coincidence of the electricity generated by the generating facility and the customer's peak demand load but that is a function of installing a generating facility; it is not a function of being served on Schedule NEM since NEM does not net Demand Charges.

[40] *See e.g.*, Complaint (C.12-08-015), at p. 3.

eligible for SCE's Domestic Service EV tariffs, including Schedules TOU-D-TEV and TOU-EV-1. These Domestic Service EV tariffs do not contain Demand Charges.

If Mr. Davis chooses to make the EV fast charger available to non-residential third parties, then SCE understands that it must separately meter that load from the Domestic Service load and serve the non-residential load on the applicable General Service rate schedule, such as TOU-GS-2 or TOU-EV-4.[41] Both of these General Service rate schedules contain Demand Charges, and these Demand Charges are applicable to all customers who are appropriately served on these rate schedules.

In sum, for NEM purposes, SCE considers the usage served on the Domestic Service meter to be Mr. Davis's "own electrical requirements" for the NEM generating facility interconnected to the Domestic Service meter. Any non-residential EV charging load appropriately served on the applicable General Service rate schedule would also be considered Mr. Davis's "own electrical requirements" for the NEM generating facility interconnected to the

[41] This requirement is found in SCE's Tariff Rule 1, *Definitions*, which defines "Domestic Service" as follows: "Service for residential use at a Single-Family Dwelling premises. Any service for other than residential use at a Single-Family Dwelling premises may be served through the domestic service meter ***only where such nondomestic connected load does not exceed 300 watts for lighting or 2 hp for power."*** (emphasis added).

General Service meter.[42] But non-residential EV charging load registered on a Domestic Service meter would be out of compliance with SCE's rate schedules.[43]

[42] Effective July 21, 2014, SCE's NEM tariff now allows Eligible Customer-Generators with additional metered service accounts located on the property where the Renewable Electrical Generating Facility is located, and/or on property adjacent or contiguous to that property, if those properties are all solely owned, leased or rented by the same Eligible Customer-Generator, to have the load of all the meters aggregated for the purposes of participating in NEM (referred to as "NEM Aggregation"). This means that Mr. Davis could install one Renewable Electrical Generating Facility on either the Domestic Service meter or the General Service meter (assuming he qualifies for this additional meter) that is sized to offset the electrical requirements of the aggregated load from both meters. The load from both meters is considered the customer's own electrical requirements for the purposes of participating in NEM Aggregation.

[43] *See* SCE's Tariff Rule 11, Section G, *Noncompliance*: "Except as otherwise specifically provided in this Rule 11, where SCE determines that a customer is in noncompliance with any tariff schedule, SCE at its option may…(1) Transfer the customer to another tariff for which the customer can qualify; or (2) Withhold payment of any credits or discounts applicable to the customer's existing tariff schedule; or (3) Discontinue service to the customer."

VII.

OTHER SAFETY CONSIDERATIONS RAISED BY THESE CONSOLIDATED PROCEEDINGS

Safety and reliability considerations are raised every time an interconnection applicant submits a request to interconnect a new generating facility, or to increase the capacity of, or make a material modification to the operating characteristics of, an existing generating facility that is interconnected with SCE's Distribution or Transmission system. These safety and reliability concerns must be evaluated on a case-by-case basis. SCE notes that the hypothetical system configurations referenced by Mr. Davis on pages 41 and 42 of the Second Amended Complaint have not been submitted to SCE in an appropriate application and thus SCE has not reviewed the system configurations for safety and reliability.

Appendix A

Witness Qualifications

SOUTHERN CALIFORNIA EDISON COMPANY

QUALIFICATIONS AND PREPARED TESTIMONY

OF JENNIFER KAMPHUIS

Q. Please state your name and business address for the record.

A. My name is Jennifer Kamphuis, and my business address is 2244 Walnut Grove Avenue, Rosemead, California 91770.

Q. Briefly describe your present responsibilities at the Southern California Edison Company.

A. I am the Program Manager for the Distributed Generation department in Customer Service Organization at Southern California Edison. For the past 3 years, I have been the Program Manager (PM) responsible for administrating the California Solar Initiative (CSI) Residential and Non-Residential programs and ensuring compliance in application processing. As the CSI PM, I am the subject matter expert on CSI Program rules and requirements set forth by the California Public Utility Commission.

Q. Briefly describe your educational and professional background.

A. I have a Bachelor's Degree in Liberal Studies for the California State University of San Bernardino. I have been an employee of SCE for three years in the Manager of Programs and Contracts role for Distributed Generation working directly on the CSI Program. Prior to coming to SCE, I worked as an Account Manager in the wholesale mortgage lending industry for 4 years. I have not previously testified before the California Public Utilities Commission.

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony in this proceeding is to sponsor portions Exhibit SCE-01, as identified in the Table of Contents thereto.

Q. Was this material prepared by you or under your supervision?

A. Yes, it was.

Q. Insofar as this material is factual in nature, do you believe it to be correct?

A. Yes, I do.

Q. Insofar as this material is in the nature of opinion or judgment, does it represent your best judgment?

A. Yes, it does.

Q. Does this conclude your qualifications and prepared testimony?

A. Yes, it does.

SOUTHERN CALIFORNIA EDISON COMPANY

QUALIFICATIONS AND PREPARED TESTIMONY

OF VISHAL PATEL

Q. Please state your name and business address for the record.

A. My name is Vishal Patel, and my business address is 3 Innovation Way, Pomona, California 91768.

Q. Briefly describe your present responsibilities at the Southern California Edison Company.

A. I am currently a Senior Power Systems Planner fulfilling the role of Manager of Generation Interconnections in the Distribution Engineering department. Distribution Engineering is a group within the Electric System Planning (ESP) department, under the Transmission and Distribution operating unit. I am responsible for overseeing a group of engineers and technical specialists that perform technical studies and other related tasks necessary to interconnect generation to SCE's distribution systems via the Rule 21 and WDAT (FERC jurisdictional) tariffs. Prior to this, I was a Senior Power Systems Planner in various Transmission Planning organizations within ESP. I have performed transmission planning studies on different portions of the SCE transmission system which have evaluated system reliability, generation interconnection and inter-utility transfer capability issues, in addition to sponsoring capital projects to maintain system reliability.

Q. Briefly describe your educational and professional background.

A. I obtained a Bachelor of Science degree in Electrical Engineering from California State Polytechnic University, Pomona. Additionally, I am a Registered Professional Engineer in Electrical Engineering in the State of California and a member of the Institute of Electrical and Electronics Engineers (IEEE). I have worked at SCE since 2006.

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony in this proceeding is to sponsor portions Exhibit SCE-01, as identified in the Table of Contents thereto..

Q. Was this material prepared by you or under your supervision?

A. Yes, it was.

Q. Insofar as this material is factual in nature, do you believe it to be correct?

A. Yes, I do.

Q. Insofar as this material is in the nature of opinion or judgment, does it represent your best judgment?

A. Yes, it does.

Q. Does this conclude your qualifications and prepared testimony?

A. Yes, it does.

SOUTHERN CALIFORNIA EDISON COMPANY

QUALIFICATIONS AND PREPARED TESTIMONY

OF ERIN PULGAR

Q. Please state your name and business address for the record.

A. My name is Erin Pulgar, and my business address is 8631 Rush Street, Rosemead, California 91770.

Q. Briefly describe your present responsibilities at the Southern California Edison Company.

A. I am currently a Manager of Programs and Contracts in SCE's Regulatory Operations Department. As such, I am responsible for providing tariff-related subject matter expertise on existing CPUC tariffs and for implementing new statutes and CPUC decisions into SCE's CPUC tariff book. I also provide tariff expertise in the resolution of informal and formal complaints with the CPUC.

Q. Briefly describe your educational and professional background.

A. I hold a Bachelor's degree in Public Relations and Political Science from the University of Southern California. I have over three and a half years of experience working at SCE. Prior to my current position, I was a project manager in the Revenue Service Organization, where I was responsible for operational compliance with SCE's billing-related tariffs. Before joining SCE, I worked six years for AeroVironment, Inc. as a program manager responsible for implementing engineering projects related to electric vehicle charging and other energy-related areas. I have not previously testified before the California Public Utilities Commission.

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony in this proceeding is to sponsor portions Exhibit SCE-01, as identified in the Table of Contents thereto.

Q. Was this material prepared by you or under your supervision?

A. Yes, it was.

Q. Insofar as this material is factual in nature, do you believe it to be correct?

A. Yes, I do.

Q. Insofar as this material is in the nature of opinion or judgment, does it represent your best judgment?

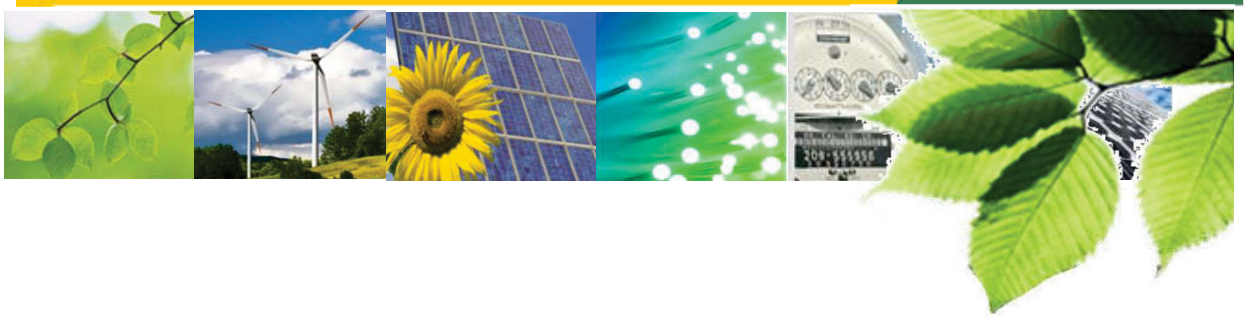
A. Yes, it does.

Q. Does this conclude your qualifications and prepared testimony?

A. Yes, it does.

Appendix B
Net Energy Metering Interconnection Handbook
Version 5.0 Effective Date: February 2014

Leading the Way in Electricity



Net Energy Metering

INTERCONNECTION HANDBOOK

SOUTHERN CALIFORNIA EDISON®

An *EDISON INTERNATIONAL*® Company

Version 5.0

Effective Date: February 2014

R-850-V5-0414

What's New

This handbook has been updated from the previous version to reflect the following:

- Section 2.2 – Provide further clarification on the applicability of the NEM tariff in reference to the 1 MW maximum system size for Eligible Customer-Generators.
- Section 5.3 /Appendix F – Shift decal and picture requirement to beginning of the interconnection application process to reduce technical review time frame.
- Section 5.5 – Clarify wiring instructions for Net Generator Output Meter (NGOM)

Contents

1. Overview

A generating facility may not be operated in parallel with SCE's Distribution facilities UNTIL PERMISSION TO OPERATE IS GRANTED BY SCE, as required in Electric Rule 21 (PDF). Unauthorized operation may result in personal injury, equipment damage and/or property damage for which the customer may be liable.

This NEM Interconnection Handbook specifies the typical minimum technical requirements to interconnect generating facilities with SCE's electric system under the Net Energy Metering (NEM) program. These requirements are necessary to ensure safe and reliable operation of SCE's electric system.

These requirements apply to interconnection of a generating facility to SCE's electrical distribution system through the NEM program under the following SCE rate schedules:

- **Schedule NEM** (PDF): Net Energy Metering
- **Schedule FC-NEM (**PDF): Fuel Cell Net Energy Metering
- **Schedule NEM-V (**PDF): Virtual Net Metering
- **Schedule MASH-VNM** (PDF): Multi-family Affordable Solar Housing
- **Schedule BG-NEM** (PDF): Biogas Net Energy Metering
  (Note: per CPUC §2827.9, biogas digester generators must have commenced operation by December 31, 2009 to be eligible for the program)

This handbook does not address other types of generator interconnections under **Rule 21** (PDF) or the **Wholesale Distribution Access Tariff (WDAT)** (PDF). Note: **Schedule RES-BCT** (PDF) (Renewable Energy Self-Generation - Bill Credit Transfer) is addressed under Rule 21. For technical requirements for interconnection under **Rule 21** (PDF) or **WDAT**, please refer to **SCE's Interconnection Handbook** (PDF).

Under the Net Energy Metering program (CPUC §2827), customers installing generating facilities are eligible to interconnect if the generating facility is located on the customer's premises, generates electricity from a renewable source pursuant to paragraph (1) of subdivision (a) of Section 25742 of the Public Resources Code (i.e., biomass, solar thermal, photovoltaic, wind, geothermal, fuel cells using renewable fuels, small hydroelectric generation, digester gas, municipal solid waste conversion, landfill gas, ocean wave, ocean thermal, or tidal current), fuel cells or biogas, or a hybrid of these technologies, and is sized to offset all or part of the customer's electrical requirements up to 1 MW.

To deliver incidental power to the grid, a customer's generating system must be located on the customer's premises and be *interconnected* to SCE's electrical system, i.e. permanently connected to allow "parallel operation" with the utility grid. (Note: for standby and back-up generators **not** permanently connected to SCE's electrical system, please refer to the notice requirements defined in **Section 5.8**).

2. Reference Information

Please visit **http://www.sce.com/nem:**

- For more information about the NEM Program, NEM Rate Schedules, and review process;
- To download checklists, applications, sample Single Line Diagrams and Plot Plan, and NEM Interconnection Agreements;
- Technical requirements for interconnection under **Rule 21** (PDF)
- To read Frequently Asked Questions and Tips to Speed through Interconnection.

2.1 Document Requirements

At **http://www.sce.com/nem**, SCE provides checklists, listing all the required documents for NEM Interconnection, as well as all the required forms along with mark-ups and sample Single Line Diagram and Plot Plan for download.

The NEM Interconnection review process is entirely paperless for solar and wind projects. NEM Interconnection application documents should be submitted to the NEM Interconnection team via email to **customer.generation@sce.com** or via fax to (626) 571-4272. **Note**: SCE can accept email attachments up to 7 MB; if the total size of attached files exceeds 7 MB, please submit them in multiple emails adding the following to the subject lines: 'part 1 of 2,' 'part 2 of 2,' etc.

Signed Interconnection Agreements can be submitted digitally for Form 14-933 and 16-344. However, originals of customer signed Agreements for Schedules **FC-NEM** (PDF), **NEM-V** (PDF), and **MASH-VNM** (PDF) must be submitted via mail to:

Southern California Edison
Attention: NEM Program
P.O. Box 800
Rosemead, CA 91770

2.2 Reference Information

Certified Equipment Listings

For CEC-certified equipment, list the manufacturer, model number, rating, voltage and other required information on the Application and Single Line Diagram ***exactly*** as shown at the following on-line resources:

Table 2.2-1: CEC Certified Equipment Listings

Equipment	Certified Listings
Inverters	Solar: **http://www.csi-epbb.com/default.aspx** Wind, Fuel Cell: **http://www.consumerenergycenter.org/erprebate/inverter.php**
Solar PV Modules	**http://www.csi-epbb.com/default.aspx**
Wind Turbines	**http://www.consumerenergycenter.org/cgi-bin/eligible_smallwind.cgi**
Fuel Cells	**http://www.consumerenergycenter.org/erprebate/eligibile_fuelcells.html**

NOTE: The certification listings above identify some of the electrical components on a generating facility. These components must be incorporated in the generating electrical design to ensure that the generating facility as whole is compliant with the NEM tariff requirements. Solely having individual components in generating facilities that are in the listing does not automatically deem a generating facility eligible for NEM. For example, a certified inverter used to interconnect a storage device may deem the generating facility ineligible for NEM even when the generating facility uses the equipment that is on the CEC certified equipment listings.

For non CEC-certified equipment, refer to the information provided by the manufacturer.

NOTE: The NEM tariff is applicable for Eligible Customer-Generators intended primarily to offset part or all of the customer's own electrical usage where the total Renewable Electrical Generating Facility capacity does not exceed 1 MW CEC-AC Nameplate rating and 1 MW aggregate inverter capacity, and must be located on customer's Premise.

Calculations

For the purposes of the NEM Interconnection Application, the following are formulas used to calculate CEC-AC nameplate system size (kW) and estimated monthly kWh output:

Table 2.2-2: CEC-AC Nameplate Calculation for Inverter based Generation Facilities[1]

Technology	CEC-AC Nameplate Calculation
Solar PV	(Qty of Modules) x (PTC Rating) x (Inverter Efficiency %) / 1000 = ____ kW
Wind	(Qty of Turbines) x (Power Output) x (Inverter Efficiency %) / 1000 = ____ kW
Fuel Cell	(Qty of Cells) x (Rated Output) x (Inverter Efficiency %) / 1000 = ____ kW

Table 2.2-4: Estimated Monthly kWh Calculation

Technology	Estimated Monthly kWh
Solar PV	Use the CSI EPBB calculator at www.csi-epbb.com or: (CEC-AC Nameplate) x 720 x 0.20 = ____ kWh
Wind	(CEC-AC Nameplate) x 720 x 0.10 = ____ kWh
Fuel Cell	(CEC-AC Nameplate) x 720 x 0.80 = ____ kWh

[1] For Non Inverter based generation facilities, SCE will use the inverter aggregate capacity.

3. Interconnection Review Process

After an initial review to confirm the Application and Single Line Diagram are complete and consistent, the NEM Interconnection team refers the project to SCE Distribution Engineering for technical review and approval. Upon referral, the installer is provided notice and contact information for the Distribution Engineer assigned to the project. At SCE Distribution Engineering's discretion, an onsite inspection and commissioning test may be required as part of the technical review – see **Section 3.2** for more information.

The design must be in accordance with:

- **Rule 21** (PDF)
- SCE's **Electric Service Requirements** (PDF)
- **SCE's Interconnection Handbook** (PDF)
- the **National Electric Code**, and
- All applicable local codes and ordinances.

SCE strongly encourages the submission of the Application and Single Line Diagram as early as possible so that any changes required as a result of SCE's technical review can be incorporated prior to installation.

If the components change from design to installation, submit revised documents with subject line 'EQUIP CHANGE' prior to scheduling the final inspection.

Failure to comply with these requirements will result in potential delay, and any corrections required to bring the project into compliance with these requirements will be at the customer's expense and must be completed before SCE will issue written authorization to interconnect in the form of a Permission to Operate (PTO) letter.

The purpose of the technical review is to facilitate the safe interconnection of eligible NEM generators to the SCE electrical distribution system. To ensure the generator interconnection is in compliance with SCE interconnection requirements, the customer's generating facility will, at a minimum, be reviewed to ensure that the generator facility will:

- not unintentionally operate in an islanded mode with SCE's electrical system as required by IEEE 1547 and UL 1741,
  - have a visible open, lockable disconnect switch and/or rackable breaker for isolation purposes,
  - comply with SCE's **Electric Service Requirements** (ESR).

If the generating facility exceeds the operating capabilities of the distribution system relative to voltage control, system overload, system operating flexibility or other system condition, it will be required to mitigate such condition prior to Field Engineering providing technical approval. An NEM customer must bear the cost of the Interconnection facilities. Please refer to Decision 02-03-057, Rule 21, Section E.4., and Public Utilities Code Section 2827(g) for the delineation of cost responsibilities for distribution modifications versus interconnection facilities.

3.1 Document Review

The following documents are required before SCE will begin the technical review of a proposed generating facility:

- Completed Application Form: see NEM Interconnection Checklists at **www.sce.com/nem** for information about which application form is required based on the project size and configuration;
- Single Line Diagram: see **Section 5.2** for detailed requirements and **Appendix A** for a sample.

The following additional information may also be required based on the size/configuration of the proposed system:

- Photos of the manual, visibly open, and lockable open AC Disconnect Switch, showing visible contact separation: see **Section 5.3** for manual, visibly open, and lockable open AC Disconnect Switch requirements;
- Plot Plan: see **Section 5.3.6** for circumstances when a Plot Plan is required and **Appendix B** for a sample.
- Inverter Specifications: see **Section 5.1** for more information;
- Photos of installed SCE provided decals, when applicable: see **Section 5.3** for more information.
- Line side / supply side taps: Please see **Appendix E.**

3.2 Commissioning Test

SCE intends to conduct a commissioning test and onsite inspection for as many sites as possible. Currently all projects greater than 10 kW are subject to a commissioning test, while projects less than 10 kW are evaluated on a case-by-case basis. When a commissioning test is required, a representative of the installer qualified to operate the equipment must be present.

Before a commissioning test will be scheduled, SCE requires a copy of an Electrical Inspection Release from the appropriate Authority Having Jurisdiction (e.g. final inspection job card from the local building and safety department) to ensure that the work on the customer's side of the meter has been permitted, meets the requirements of the **National Electric Code**, applicable local codes and ordinances, and is therefore safe to energize.

The onsite inspection will ensure that the installation reflects what is shown on the single line diagram and documents provided by the applicant on the generating facility. **Rule 21**, Section H, voltage and frequency requirements will be tested and verified during the commissioning test. Regardless of the results of the onsite inspection and commissioning test, the customer may not energize the system until SCE issues a Permission to Operate (PTO) letter.

3.3 Interconnection Study

If, during the course of the initial and supplemental reviews, it is determined that an interconnection study is required, SCE will determine the study timetable on a case-by-case basis. The interconnection study will detail any additional interconnection facilities or distribution system modifications that will be needed to accommodate the applicant's generating facility. If the generating facility exceeds the operating capabilities of the distribution system relative to voltage control, system overload, system operating flexibility or other system condition, it will be required to mitigate such conditions prior to Field Engineering providing technical approval.

3.4 Review Fees

There are no application and review fees for NEM interconnection requests. Please refer to Rule 21, Section E.2.c

4 Operating Evaluations

The generator shall not energize or export power to the SCE system during any interruption to the supply that serves the Point of Common Coupling. The applicant's generation may be operated during such interruptions only with an open tie to SCE.

Islanding[2] with SCE systems will not be permitted under any circumstance.

Technical Approval is based on the following criteria:

- **15% Rule**: the applicant's generating system combined with existing generation does not exceed 15% of the maximum loading of line section. For more information, please refer to **Rule 21** G.1.m.
- **Overloading**: all distribution equipment must not be overloaded by the applicant's generating system.
- **Voltage Operating Levels**: the applicant's generating system must not create a voltage drop or rise that is outside the allowable operating-voltage bandwidth specified in **Rule 21** and **Rule 2** (PDF).
- **System Upgrades:** upon review by SCE Distribution Engineering, system upgrades may be required to allow the system to accommodate the interconnection of the generating facility.

NOTE: For technical analysis defined in this Handbook, SCE Engineering will use the Aggregate Inverter Capacity.

Please refer to Section 3 (above) for the delineation of cost responsibilities for distribution modifications versus interconnection facilities.

Following a generation facility disconnect as a result of a voltage or frequency excursion (parameters are described in **Rule 21** Section H 1. a. 2), the generation facility shall remain disconnected until the service voltage and frequency has recovered to SCE's acceptable voltage and frequency limits for a minimum of sixty (60) seconds.

4.1 Normal Voltage Operating Range

To minimize the adverse voltage effects experienced by other customers on SCE's electric system, any voltage flicker at the point of common coupling (PCC) caused by the generating facility must not exceed the limits defined by the "**Maximum Borderline of Irritation Curve**" shown in the Institute of Electrical Engineers (IEEE) 519, **Rule 2** (PDF), and **Rule 21** (PDF).

[2] Rule 21, Section C, Definitions.

4.1.1 Limits Specific to Single-Phase Generating Facilities

When connected to a single phase transformer, the generator must be installed such that the aggregated gross output is balanced between the two phases of the single phase voltage and the maximum aggregated Gross Ratings for all the Generating Facilities shall not exceed the transformer rating.

4.1.2 Limits Specific to Three-Phase Generating Facilities

The applicant must balance the demand load and generation as nearly as practical between the two sides of a three-wire single-phase service and between all phases of a three-phase service.

The difference in amperes between any two phases at the customer's peak load should not be greater than 10 percent or 50 amperes (at the service delivery voltage), whichever is greater; except that the difference between the load on the lighting phase of a four-wire delta service and the load on the power phase may be more that these limits. It will be the responsibility of the customer to keep the demand load balanced within these limits.

5 Miscellaneous Requirements

5.1 Inverter

An inverter-based generating facility must meet all required criteria specified in the CPUC's "**Rule 21**-Generating Facility Interconnections", **IEEE 1547**, **UL 1741,** and **SCE's Interconnection Handbook** (PDF). If the inverter does not meet Underwriters Laboratories Standard **UL 1741** certification CSA, OR specifically meets Section "L" of **Rule 21** (PDF), as tested by a nationally recognized testing laboratory (NRTL) acceptable to SCE with the test reports acceptable to **IEEE 1547**, **Rule 21** (PDF) and SCE, additional protection requirements and testing may be required.

Inverters listed in the following lists have met **UL 1741** and **IEEE 1547** standards:

- Underwriters Laboratories Standard **UL 1741** certification , or
- Section "L" of **Rule 21** (PDF), as tested by a nationally recognized testing laboratory (NRTL) acceptable to SCE and the test reports must have been approved by SCE.

The California Energy Commission maintains a certified list of approved inverters at **http://www.consumerenergycenter.org/erprebate/inverter.php**. If one of these inverters is used, the application process is greatly simplified and expedited. If not, the customer may be required to provide additional details and the utility may need to perform additional studies to determine how the proposed system will perform under fault conditions and prevent islanding.

Note: SCE may require additional testing for a single installation of multiple CEC-approved inverter units.

To be eligible for CSI credits, the inverter must be listed at **http://www.csi-epbb.com/**.

Separate single-unit or multiple-unit inverters that do not meet **UL 1741** certification or have not been adequately tested will not be granted commercial operation status and the customer will not be permitted to interconnect to SCE's electrical distribution system.

SCE reserves the right to disconnect previously certified interconnected units when Underwriters Laboratories decertifies the units. SCE may implement an acceptable mitigation procedure for recertification at the customer's expense.

5.2 Single Line Diagram

See Appendix A for a sample Single Line Diagram.

The Single Line Diagram shows the path and graphic symbols of the entire electrical system for the site to provide a good understanding of the connections and component use. "Best" single lines provide, on one side of the page, a sequence of events such as what happens during an SCE interruption and which devices close and/or open to return the generation system to normal status. Any and all additional information necessary to demonstrate compliance with **Rule 21** and SCE's **Electrical Service Requirements** (ESR) should be provided.

Depending on the system, the following should be included on the Single Line Diagram:

- Site location/service address (must match address on SCE account and NEM Interconnection Application);
- Detail view of the point of connection to the power grid, specifically showing whether it is on the utility or customer side of the main breaker - see below for additional requirements that apply when the point of interconnection is on the utility side of the main breaker (line-side tap) **Appendix E**;
- Service Panels;
- Protective devices: Circuit Breakers, Fuses, CT and PT ratings, if applicable;
- Utility meter;
- Generation Output Meter(s), of applicant, including built in within component;
- Generator(s) make and model;
- Detailed component information (characteristics) is included for each component (Voltage and phase of inverters, transformers, etc.);
- Inverter setting for: Under-Voltage, Extreme Under-Voltage, Overvoltage Extreme Voltage, Over-frequency, Under-frequency;
- Other Generation type and system size, such as emergency battery backup, diesel generator, permanently connected generators, etc. including their related interconnection equipment such as open transition transfer switches, relays and control systems;
- Manual, visibly open, and lockable open AC disconnect switch, including make and model (all info outlined in proposed SLD) – see **Section 5.3** for Manual, Visibly Open and Lockable AC Disconnect requirements;
- Code and version to be used for construction and repair, inspection and testing.

Additional Requirements for Line-Side Taps
When the point of connection to the power grid is on the utility side of the main breaker, the **Single Line Diagram** must also include:

- Protective device information;
- Signed PE Stamp.

For Physical connections, please refer to **Appendix E**

CAUTION ABOUT BROKEN METER SEALS:
Per **ESR-**5, Section 1.0, (pp 5-7), all enclosures and raceways on the line side (unmetered) or housing metering equipment shall be sealable. **Meter seals shall not be broken by anyone except an authorized SCE employee**.

Per **ESR**- 6, Section 1.0 (pp 6-5), **conductors shall not be rerouted through any metering compartment.** Fused and unfused conductors shall not occupy the same raceway unless they are completely barriered from each other in a manner acceptable to SCE.

Per **ESR-** 6, Section 5.0, Figure 6-8 (pp 6-20), except for conductors supplying the instrument-transformer compartment, and the ground bus, no other conductors or devices shall be installed in, or routed through, the compartment or the sealed area above the compartment. The ground bus shall not infringe on utility-compartment space, or reduce any clearances. Customer connections to the ground bus shall be allowed in the instrument transformer compartment.

5.2.1 Visible Open AC Disconnect Switch requirements for generation interconnection to distribution voltages 34.5KV or below[3]

Per SCE guidelines, a visible open, lockable AC Disconnect is required for all of the following aggregate generating facilities:

- All Commercial
- All Residential Non Self-Contained Meters
- All Line-Side Taps (additional overcurrent protection required)

Refer to **Rule 21** Section H.1.d and **SCE's Interconnection Handbook** (PDF) for Visible open Disconnect requirements.

5.2.2 Disconnects must be reviewed and approved by Field Engineering. Location of AC Disconnect

In order for SCE to operate and maintain the distribution system safely and reliably, it is mandatory that all electrical sources to the SCE's distribution system have the ability to be disconnected from the system with a single, visible open and lockable switching device. Having the ability to disconnect and to secure the disconnection of the various electrical sources will allow SCE's workers to safely perform the required maintenance to the

If you come across a broken meter seal, report it immediately to (800) 655-4555.

[3] SCE's Interconnection Handbook provides the requirements for voltage greater than 34.5KV.

distribution system by removing, tagging and taking the required clearances to the system where maintenance is to be performed. SCE's distribution system is designed with switches and other devices that can be used to disconnect the SCE source to any section of the distribution system. However, in order to achieve the required, complete isolation from all the sources, the generation facility sources that are connected to the distribution system must also have the capability of being securely disconnected with a single, visible open and lockable switching device. While SCE acknowledges that in some cases, installing the required disconnecting device may significantly increase the cost of the interconnection, SCE must ensure that the system is safe to operate and maintain and thus must require the appropriate disconnecting device. SCE will accept the following alternatives to installation of a visible open and lockable disconnect in order to maintain the ability to disconnect the generating facilities from the distribution system:

5.2.3 Self-Contained Meter[4] with one main switch (CB)

For these facilities, SCE can utilize the SCE revenue meter to disconnect the generation and load from the SCE distribution system. See ***figure-1*** for typical system configuration. In order to use this option, the following requirements must be met:

1. Facility must have a main breaker that can be operated by the customer on the same metering switchboard (meter panel) as the revenue meter.
2. Customer must agree that when it is necessary to disconnect the generating facility by opening the main CB and then removing the revenue meter, the customer will also experience an outage to the customer's facility until the meter is re-installed.

Restrictions:

For the facilities or the conditions below, the option of removing the revenue meter for disconnection purposes is not available and the customer must install a visible open and lockable disconnect adjacent to the PCC or an approved location that should be on line of sight with approved signage and on a single disconnecting switching device as required by Rule 21 and SCE's Interconnection Handbook.

a) Facilities which do not have a main CB in the metering enclosure.

b) Generating facilities that are proposing to connect to the source side of the CB (when allowed)

c) When customers do not agree on facility outage when required to disconnect the generator from the distribution system.

[4] Reference SCE's Electrical Service Requirements for information on Self Contained Meter

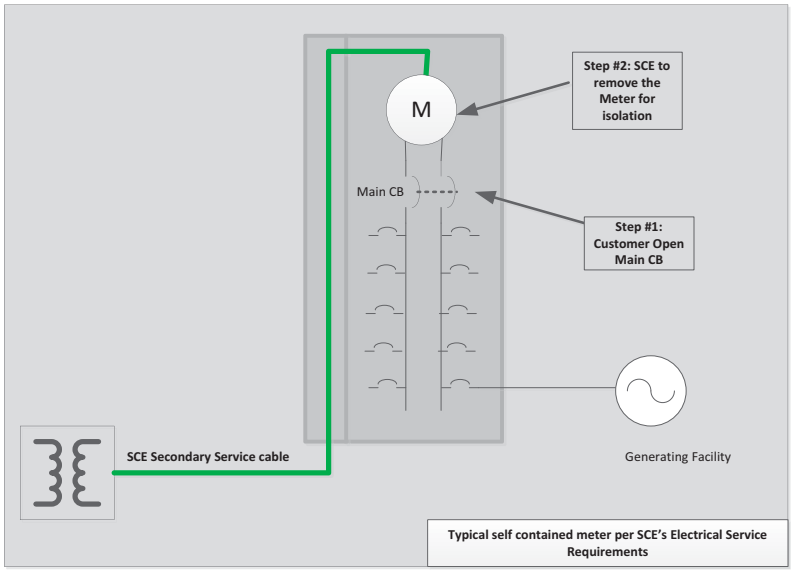


Figure 1- Typical self-contained meter system

5.2.4 Non Self-Contained Meter – Secondary Voltage Connection

These generation facilities cannot be disconnected by simply removing the revenue meter as the metering is achieved by current transformers (CTs). Refer to ***figure 1.2*** for typical installation. These types of installations are typically utilized for medium-sized commercial or industrial customers. For these types of systems, the following are the disconnect device requirements:

1. Must comply with **Rule 21**section H.1.d – Visible Open Disconnect Requirement and **SCE's Interconnection Handbook** section 5.11.1- Manual disconnect.
2. One single disconnect is to be used to disconnect all generation at a facility.
   a. When adding additional generation to a facility that currently has generation at the facility, the added generation must be connected to the existing disconnecting device.
3. The visible open disconnect must be adjacent to the Point of Common Coupling (PCC) ***or an approved location that should be in line of sight with approved signage*** and must comply with access requirements per **Rule 21**section H.1.d.
   a. Inside the same electrical metering room
   b. Immediately outside the electrical metering room
4. Location of visible open disconnect must be approved by SCE prior to installation.
   a. Plot plan outlining the locations of the visible open disconnect must be provided in the interconnection request.

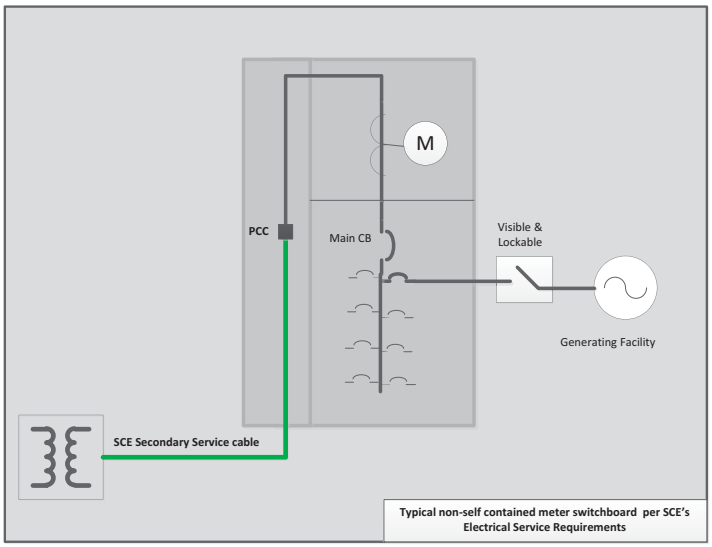


Figure 2 - Typical non-self-contained meter switchgear

5.2.5 Primary Service Voltage Connections

These types of installations are typically utilized by large customers or by customers that have a campus style electrical system. For these types of installations, the generation is typically installed on a panel fed by the customer's transformers (***see figure - 3***). For these types of installations, it becomes extremely difficult to comply with the "**one single disconnect at the PCC**" requirement. SCE's main intent is to have the ability to remove the generation from SCE's distribution system so that SCE personnel may work on the distribution system safely. To this extent, SCE and the customer can agree to use the customer's main rackable breaker to provide the disconnecting means when it is necessary to remove the generation from the SCE's distribution system. The following are the requirements:

1. Facility must have a main breaker that can be opened and racked-out by the customer.
   a. SCE's clearance policies can take a clearance to a customer CB when SCE can take control over the CB. This would be accomplished by witnessing that the CB was racked out and by applying SCE's lock and tagging procedures.
2. Customer must agree that when necessary to disconnect the generating facility by opening and racking-out the CB, the customer will also experience an outage to the customer's facility.
   a. Customer must provide a letter on their company letterhead stating agreement with this concept.

Restrictions:

For the facilities or the conditions below, the option of using the main breaker for purposes of disconnecting the generation facility is not available and the customer must install a visible open and lockable disconnect as required by Rule 21 and SCE's Interconnection Handbook near the PCC and on a single disconnecting device.

a) Facilities that do not have a main CB that is capable of being racked-out.

- ***Customer may replace the CB section with a rackable CB in order to meet the requirement.***

b) When customer does not agree on facility outage when isolating the generator from the distribution system.

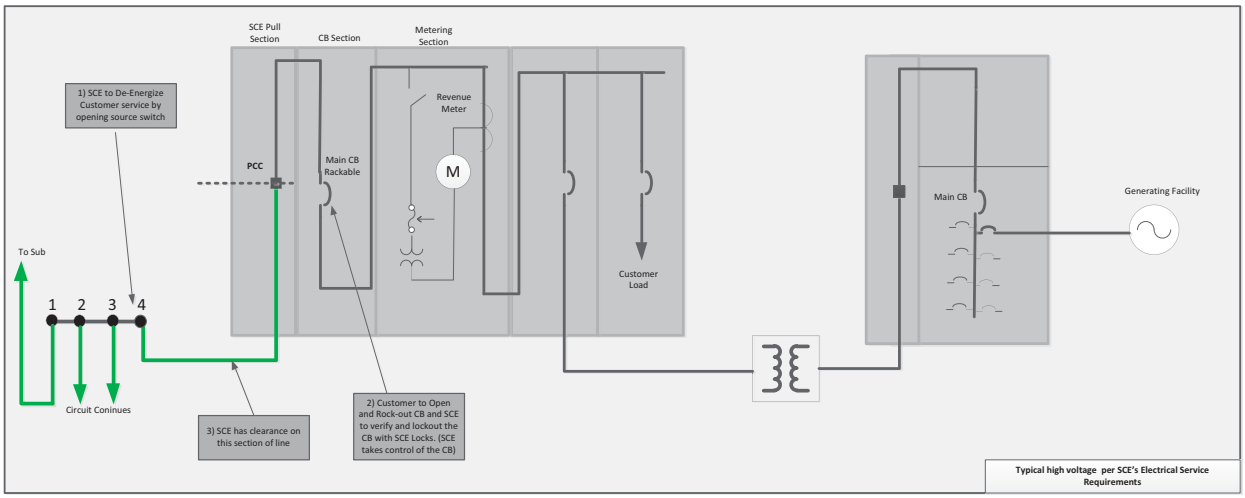


Figure 3 - Typical high voltage service interconnection

5.2.6 Plot Plan Requirement

See Appendix B for a sample Plot Plan.

If the manual, visibly open, and lockable AC disconnect is required, a Plot Plan must be provided to SCE Distribution Engineering for review, showing the location of the manual visibly open and lockable open AC disconnect switch with reference to the utility meter.

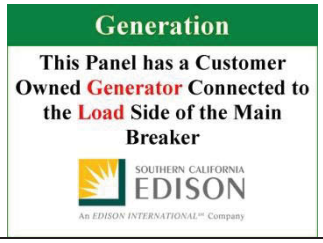
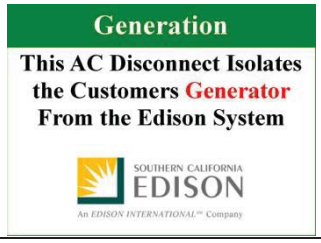
5.2.7 Circumstances when AC Disconnect May be Opened by SCE

The manual, visibly open, and lockable open AC Disconnect Switch or rackable circuit breaker may be operated by SCE under the following circumstances:

- Pre-emergency or emergency conditions on the SCE system.
- A hazardous condition is revealed by an SCE inspection.
- To eliminate a condition that constitutes a potential hazard to SCE personnel or the general public.
- When protective device tampering is discovered.
- A generator-owner has failed to make available records of Verification tests and maintenance of its protective devices.
- A generator-owner's system interferes with SCE equipment or equipment belonging to other SCE customers.
- A generator owner's system is found to affect quality of service of adjoining customers.

5.3 Signage Requirements

SCE requires decals or permanent signage to be installed on generation facilities in order to identify customers that have generation onsite. A photograph with the installed decals must be submitted to the NEM Interconnection team with the final Permit Inspection (see section 2.1). SCE will verify the decal installation during the final technical approval by local Field Engineering or Service Planning.

Decals that will be installed on the customer's main service panel	Decals that will be installed on the AC Disconnect to be used for utility isolation of the generator
	

You have the option to receive the decals by the following method:

1. You may elect to have up to 20 sets of decals sent to you. Please send a self-addressed stamped envelope with sufficient postage to mail a total weight of 3.4 ounces to the following address:

   Attn: SCE Field Engineering Support

   2885 West Foothill Blvd.

   Rialto, CA 92376

2. You may contact the Field Engineer assigned to your project to coordinate decal pick up at the local service center.

Once you have identified a vendor to make each type of decal, please send a sample set with vendor and contact information for approval. You can have an approved vendor make SCE decals in bulk at your convenience. Please see **Appendix F** for instructions.

SCE decal placement does not authorize the generation facility to operate in parallel. You may only turn on your system once you have received official notification from SCE

5.4 Telemetering

Please refer to section 7 of **SCE's Interconnection Handbook**) for information about telemetry requirements.

5.5 Net Generation Output Meter (NGOM)

A Net Generation Output Meter (NGOM) may be required as indicated in the applicable Rate Schedule – see section 1 for a list of Rate Schedules. Please see **Figure 4** for additional requirements.

For Virtual Net Energy Metering projects, either **Schedule NEM-V** or **Schedule MASH-VNM,** a NGO meter will be required and paid for by the customer, also the customer will provide and install the NGO meter socket per the **ESR**. The point of interconnection must be made in parallel to other SCE revenue meters and not in SCE sealed sections. Refer to the **Electrical Service Requirements** section 1.12., and **Figure 5** for wiring instructions of the NGO socket.

5.5.1 AC Disconnect requirement for NGO meter sockets

When a NGO customer meter socket is installed, a line side and a load side ganged operated, visible open, lockable AC Disconnect shall be installed. See **Figure 4.**

- For NGO meter socket rated at greater than 600 V, the AC Disconnects shall be installed directly adjacent to the NGO meter socket.
- For NGO meter sockets rated at 600 V or below, the AC Disconnects shall be installed in line of sight of the NGO meter socket.

These AC Disconnects may be in addition to the singular AC Disconnect to isolate the entire generation facility.

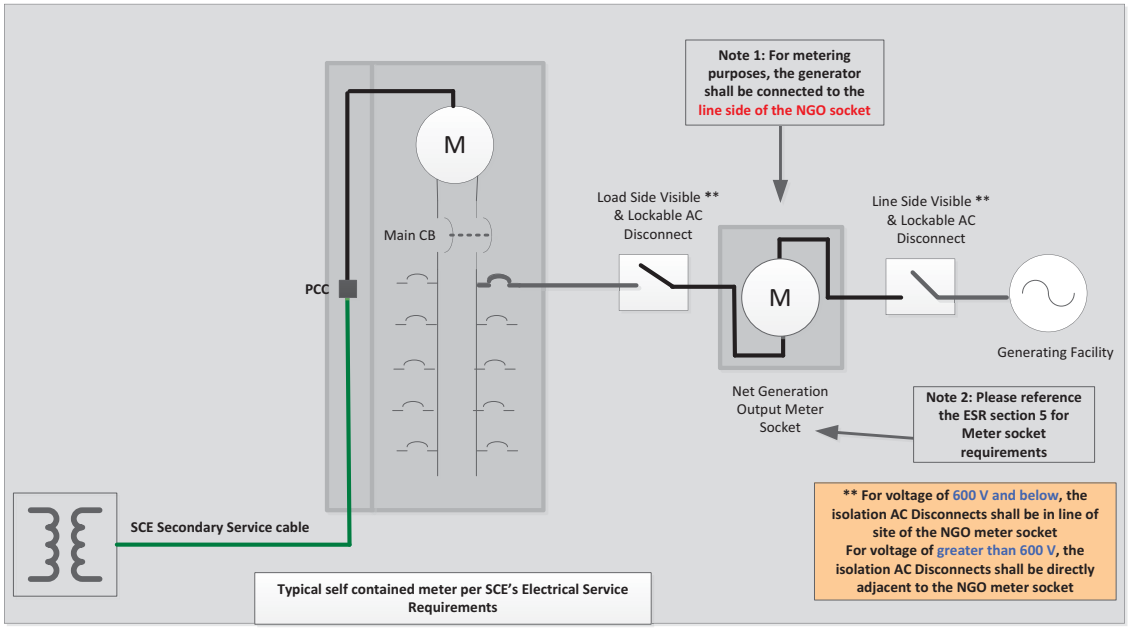


Figure 4 - Typical self-contained meter system with NGO metering and AC Disconnects

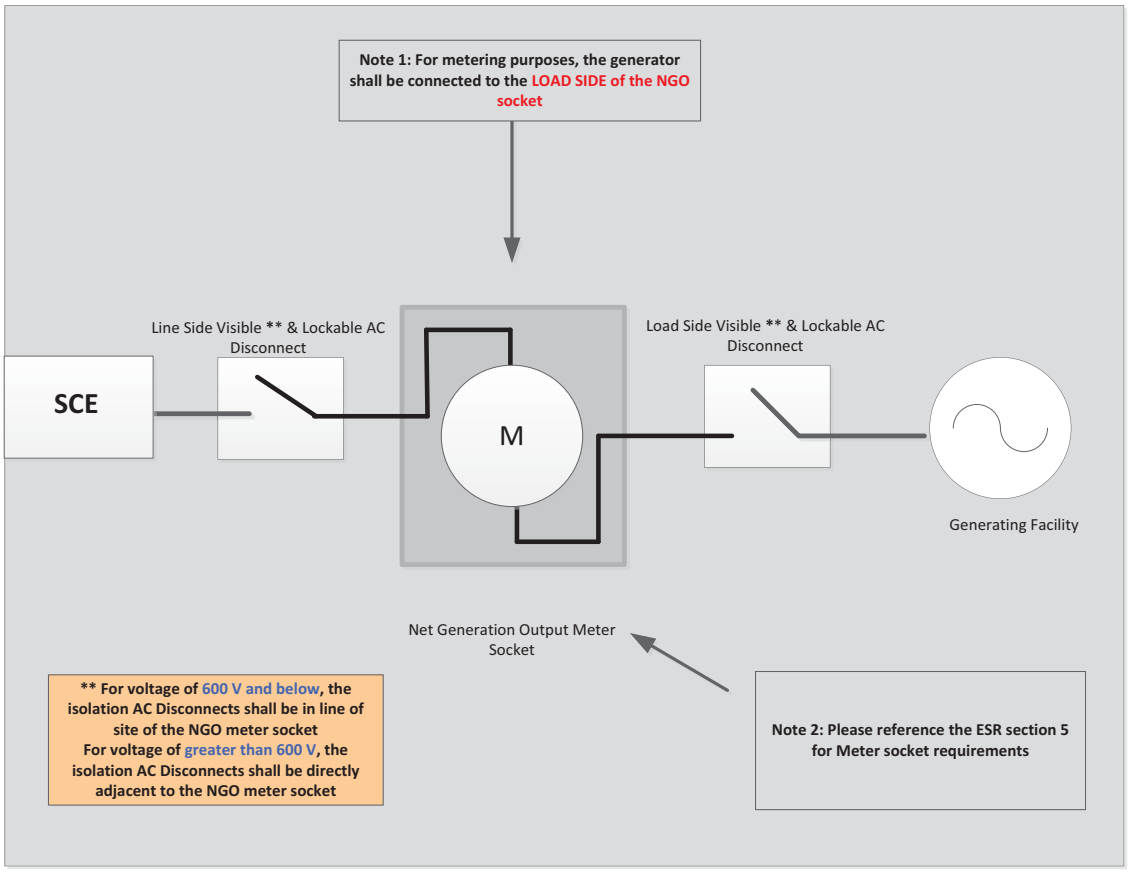


Figure 5-Wiring of a NGO meter socket for Virtual Net Metering projects

5.6 Generating Systems with Battery Back-Up

Back-up generators are typically used to provide electrical power to the facility during electrical outages of SCE's electrical grid. There are several forms of back-up generation including battery back-up, diesel generators, fly-wheels, etc.

Battery back-up systems when used in conjunction with an NEM project must be designed to be in an isolated mode and not parallel with SCE system under any condition. Typically this isolation mode can be accomplished via use of an "open transition" transfer switch but other means can be used to accomplish the isolation requirements. These types of system will require SCE approval and may also require a separate Rule 21 interconnection request.

5.7 Secondary Network Interconnection

Interconnection of NEM facilities onto SCE's secondary network distribution system is permitted. However, due to the complexity of secondary networks, additional requirements must be met to ensure continued reliable operation of the network.
In addition to standard NEM requirements, NEM interconnections must use one of the following to ensure non-export to the SCE secondary network:

- (Preferred) An under-power relay (minimum-import relay) should be installed to monitor power flow at the PCC. The relay should be set to disconnect the NEM generator from the SCE system when input power at the PCC falls below **Rule 21, G.1.i.** requirements (5% of the Generating Facility's total Gross Nameplate Rating, with a maximum 2.0 second delay).
- A reverse power relay should be installed to monitor power flow at the PCC. The relay should be set to disconnect the NEM generator from the SCE system when reverse power flow at the PCC falls exceeds **Rule 21, G.1.i.** requirements (0.1% of the service transformer's rating, with a maximum 2.0 second delay).
- Install dynamically controlled inverters (DCI) that monitor power flow at the PCC and will initiate a reduction of power output from the NEM to maintain a minimum import level.

6 Protection Requirements

The interconnection of a new NEM generation facility to the SCE distribution system must not degrade any of the existing SCE protection and control schemes nor lower the existing levels of safety and reliability to other customers.

Generating Facilities operating in parallel with SCE's Distribution system shall be equipped with the following Protective Functions to sense abnormal conditions on SCE's Distribution System and cause the Generating Facility to be automatically disconnected from SCE's Distribution System or to prevent the Generating Facility from being connected to SCE's Distribution System inappropriately:

- Over and under voltage trip functions and over and under frequency trip functions.

- A voltage and frequency sensing and time-delay function to prevent the Generating Facility from energizing a de-energized Distribution System circuit and to prevent the Generating Facility from

reconnecting with SCE's Distribution System unless SCE's Distribution System service voltage and frequency are within normal operating limits and are stable for at least 60 seconds.

- A function to prevent the Generating Facility from contributing to the formation of an Unintended Island, and cease to energize SCE's Distribution System within two seconds of the formation of an Unintended Island (Island; Islanding: A condition on SCE's Distribution System in which one or more Generating Facilities deliver power to customers using a portion of SCE's Distribution System that is electrically isolated from the remainder of SCE's Distribution System.)

- The Generating Facility shall cease to energize SCE's Distribution System for faults on SCE's Distribution System circuit to which it is connected (IEEE 1547-4.2.1). The Generating Facility shall cease to energize SCE's Distribution circuit prior to re-closure by SCE's Distribution System equipment (IEEE 1547-4.2.2).

Please reference SCE's Interconnection Handbook for additional information.

The customer's system-protection facilities are at the customer's expense, and must be installed, operated, and maintained in accordance with all the applicable regulatory requirements and in accordance with the design and application requirements of this Handbook.

6.1 Inverter Protection Settings

Approved voltage and frequency setting per SCE's **Rule 21** below:

- If inverter is 30KW or below, protection settings approved if inverter is UL listed (all CEC approved inverters meet this guideline)

- If inverter is larger than 30kW, protection settings are field adjustable
  - Verify that it is UL listed
  - Verify settings on each inverter during commissioning test by installer displaying settings on connected computer or on inverter panel.

If settings cannot be verified during a commissioning test, obtain a letter from the inverter manufacturer providing the inverter settings and their respective serial number. Distribution Engineering will verify the proposed settings to ensure that they meet **Rule 21, Section H** requirements -- see Appendix C.

Table 7.1-1 Voltage Relay Settings

Element	Element Name	Settings (< or =) % of Nominal	120V Base	480V Base	208V Base	Maximum Timing	
						Cycles	Seconds
27	Extreme Under-Voltage	50%	60	240	104	10	0.167
27	Under-Voltage	88%	105.6	422.4	183	120	2
59	Over-Voltage	110%	132	528	228.8	60	1
59	Extreme Over –Voltage	120%	144	576	249.6	10	0.167

Note: Producer can set relays more stringent than required by **Rule 21**. Such is the case in inverter systems.

Table 7.1-2 Frequency Relay Trip Settings

Element	Element Name	Settings	Maximum Timing	
			Cycles	Seconds
81O	Over-Frequency	> 60.5 HZ	10	0.167
81U	Under-Frequency	< 59.3 HZ	10	0.167

Unless otherwise required by SCE, a trip frequency of 59.3 Hz and a maximum trip time of 10 cycles shall be used.

6.1.1 Ground-Fault-Sensing and Stabilization

When required by **SCE's Interconnection Handbook** (PDF), a ground-fault-sensing scheme detects SCE's ground faults and trips the generator breaker or the generator's main circuit breaker, preventing the generator from continuously contributing to the ground fault.

Ground-fault-sensing scheme will consist of either a ground detector or ground bank depending on the configuration of SCE's power system.

7 Definitions

Accessible: A device that is accessible to SCE maintenance personal consistent with **Rule 21** (PDF) requirements.

Anti-Islanding: A control scheme installed as part of the Generating or Interconnection Facility that senses and prevents the formation of an **Unintended Island**.

Island; Islanding: A condition on SCE's Distribution System in which one or more Generating Facilities deliver power to customers using a portion of SCE's Distribution System that is electrically isolated from the remainder of SCE's Distribution System.

Line-Side Tap: A point of interconnection on the utility, or line side of the main breaker.

Load-Side Tap: A point of interconnection on the customer, or load side of the main breaker.

Lockable: The disconnect must have provisions for a common 3/8" padlock, used as part of normal SCE maintenance lockout procedure. (see **Section 5.3** Manual, Visibly Open and Lockable AC Disconnect Switch)

Non-Islanding: Designed to detect and disconnect from a stable **Unintended Island** with matched load and generation. Reliance solely on under/over voltage and frequency trip is not considered sufficient to qualify as Non-Islanding.

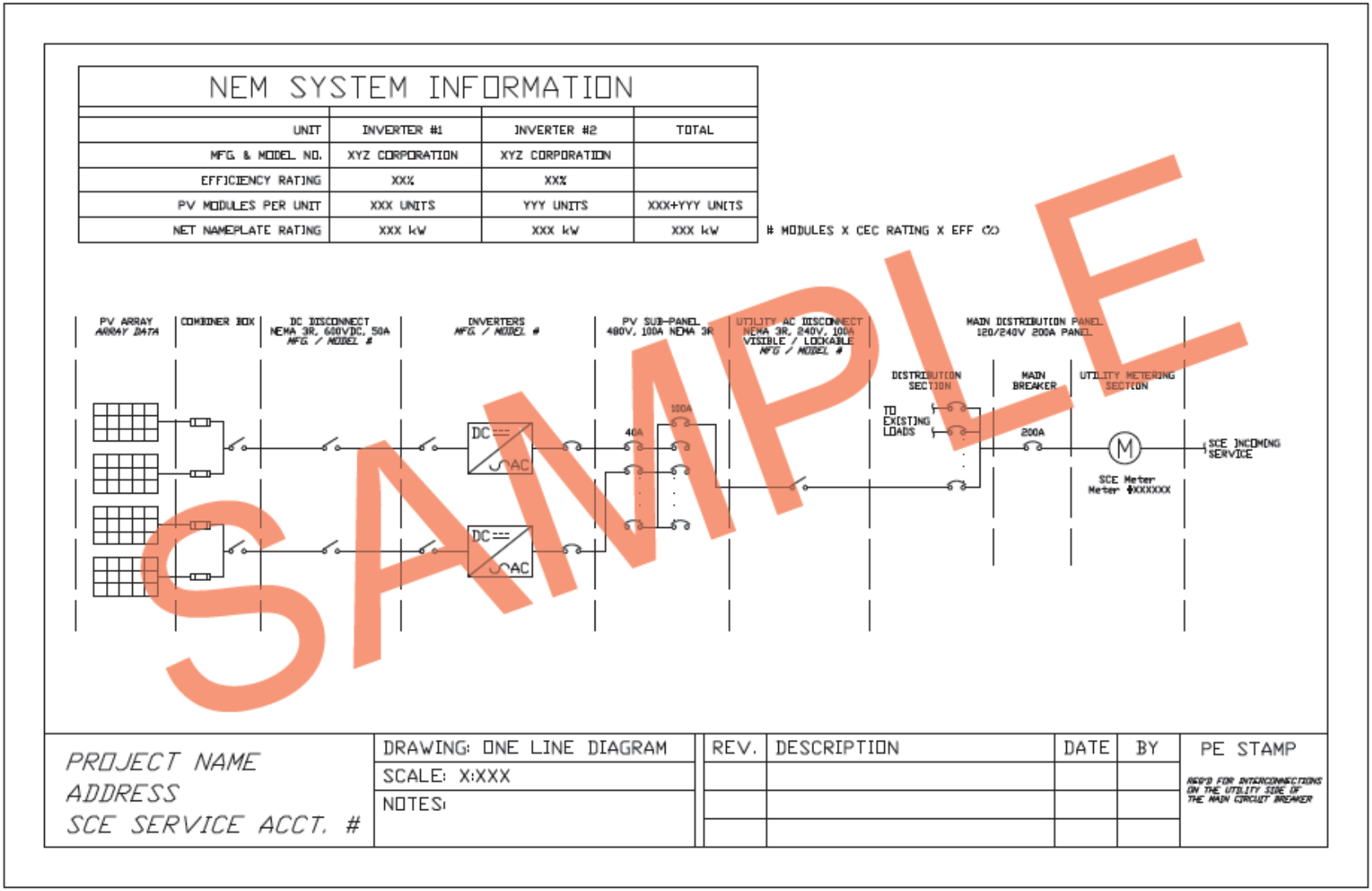
Non -Self Contained Meter: An SCE revenue grade meter at a customer panel that uses external current transformers to measure the flow of current.

Standard: Located on the customer's premise, must use UL listed inverter(s), with a point of interconnection on the customer side of the main circuit breaker, does not require a Net Generation Output meter, and is the sole generator onsite (no backup systems, no battery backup systems, etc.)

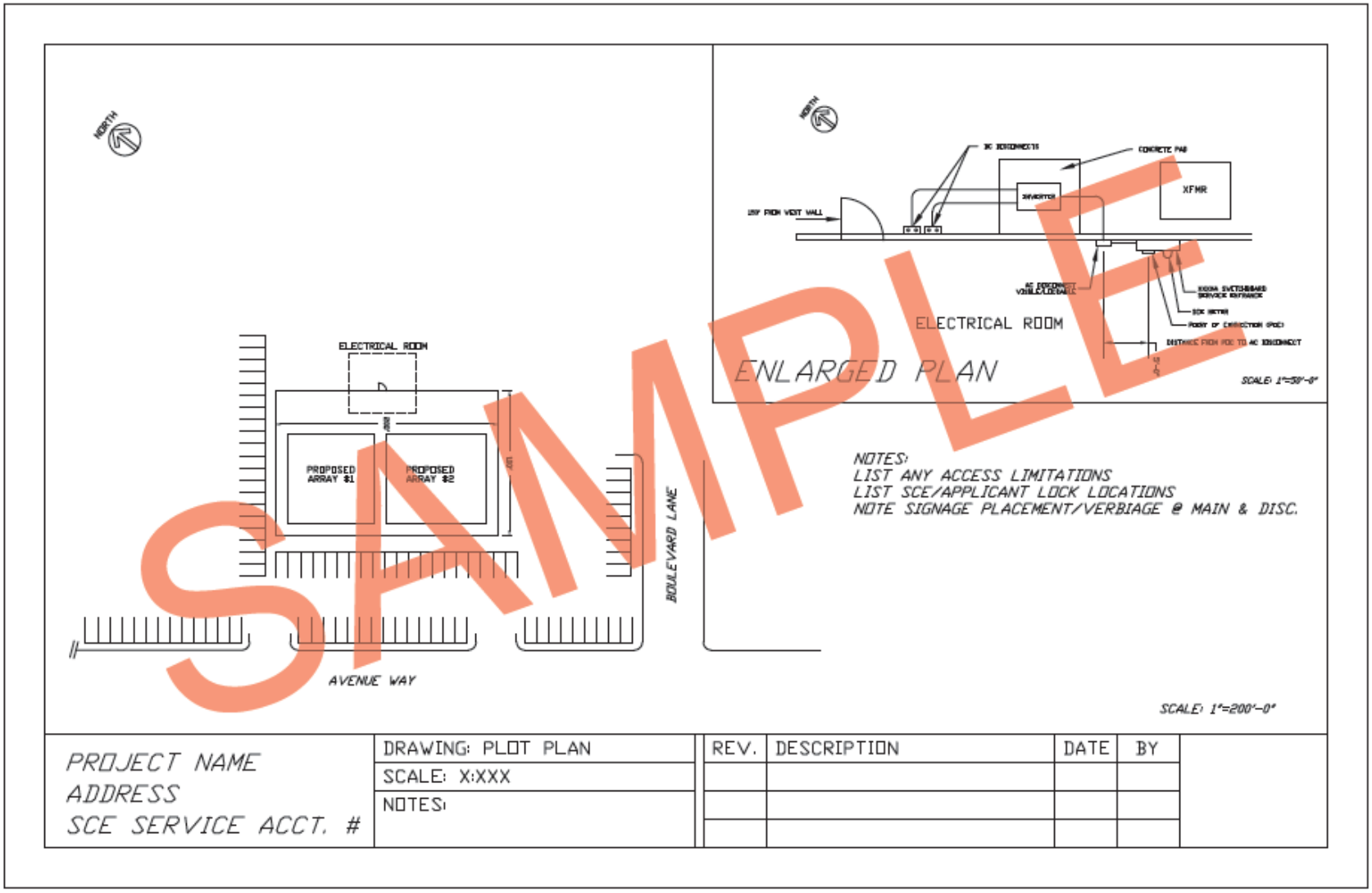
Unintended Island: The creation of an **Island**, usually following a loss of a portion of SCE's Distribution System, without the approval of SCE.

Visible Open: Visible means visible break; when the disconnect is in the open position, there is a visible separation between the contacts, and the separation may be observed without disassembling the device. Typically, this switch contains visible blades inside an enclosure, an external lever, and a positive indication that the switch is in the off position. (see **Section 5.3** Manual, Visibly Open and Lockable AC Disconnect Switch)

Appendix A: Sample Single Line Diagram



Appendix B: Sample Plot Plan



Appendix C: Inverter Settings Request

[Company Logo]

Friday, November 05, 2010

SCE Project NM #:

Inverter Model: _____

These settings apply to the following Serial Numbered Inverters:

1234-56789, 9876-54321, & 4561-23789

Project Location Address: *Enter Address Here*

Base Voltage (Nominal voltage):_____

Table 1: Voltage Trip Settings

Description	Actual Level		Actual Time
Extreme Under Voltage		%	s or cycles
Under Voltage		%	s or cycles
Extreme Over Voltage		%	s or cycles
Over Voltage		%	s or cycles
Under Frequency		Hz	s or cycles
Over Frequency		Hz	s or cycles

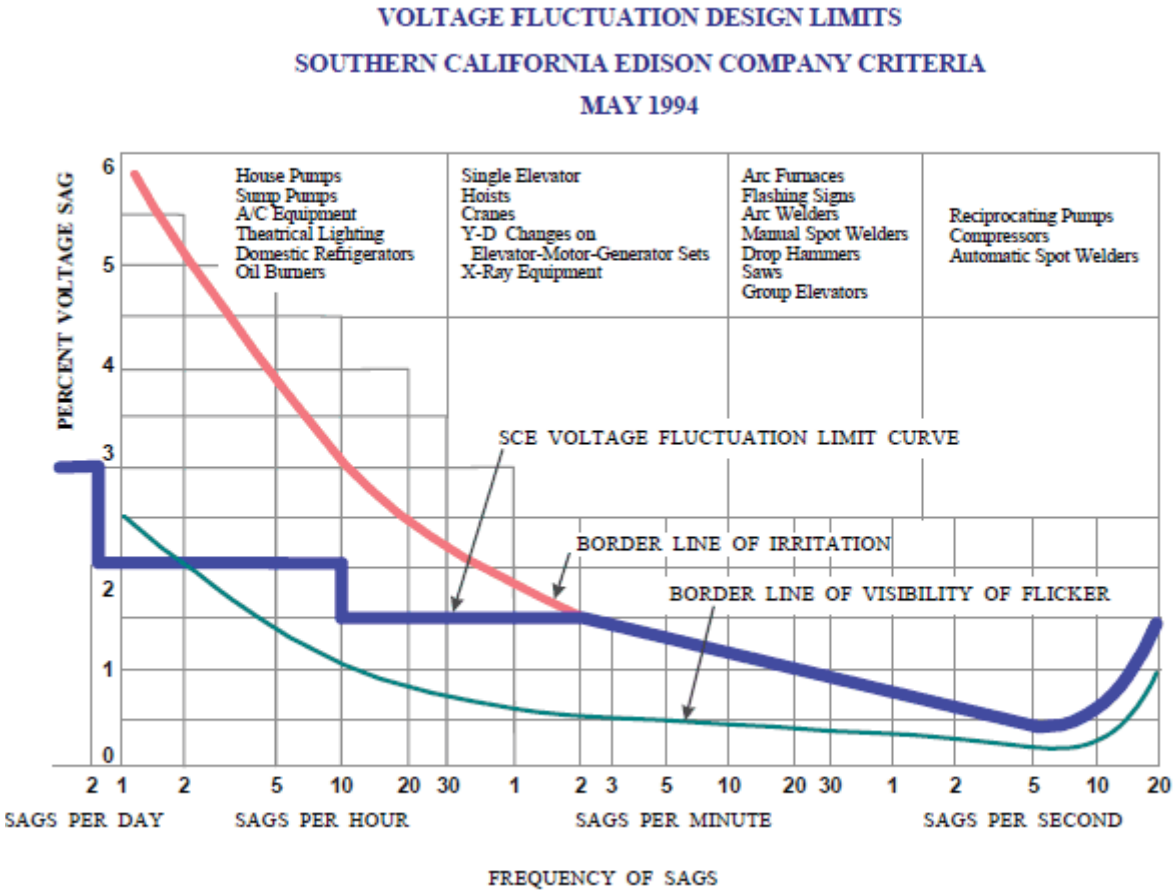
Best regards,

[Signature of representative]

Manufacture Representative

Manufacture Contact Information

Appendix D: Maximum Borderline of Irritation Curve



Appendix E: Supply Side / Line Side connections

To: _____ SCE Project #: _____

SCE has received the application for a ___KW solar generating facility located at _____.

The single line for the proposed project indicates that the proposed method of interconnection to the SCE system is to connect the generating facility to the source side of the existing customer's main breaker (Line Side Tap). This proposed method of interconnection requires the existing interconnecting switchgear equipment (busses, connectors, termination points, etc.) to be modified in order to connect the generation on the source side of customer's main circuit breaker. Such modifications could compromise the UL certification of the existing switchgear and could compromise the ratings and withstand capabilities that the switchgear was originally designed for. SCE strongly encourages the customer to modify its proposed method of interconnection, and interconnect the generating facility to the load side of the main circuit breaker in accordance with the original intent of the existing switchgear.

SCE considers the project's proposed method of interconnection to be a potential safety issue because of the modification of the switchgear. To ensure that the project's interconnection facilities meet SCE's safety requirements, SCE must receive verification of UL compliance for the modifications to the existing switchgear. This can be accomplished in the following ways:

1. A copy of the attached verification signed by the inspecting authority, acknowledging the following: (1) that the existing customer switchgear has been altered to allow the interconnection of the generating facility to the source side of the customer's main breaker; and (2) that the altered customer switchgear continues to meet UL certification requirements or that the modified equipment has been recertified for its new configuration.

2. A document from the manufacturer of the existing panel indicating that the proposed modification or connection to the source side of that panel does not compromise the UL rating of the panel.

3. A UL certification of the proposed modification or connection to the source side of the main circuit breaker of the existing panel

SCE must receive one of these verifications before it will approve the generating facility for interconnection to SCE's distribution system via the source side of the existing customer's main breaker (Line Side Tap). It should be noted that in addition to the requirements above, the customer must comply with existing requirements including a P.E stamped Single Line, plot plan, equipment requirement, etc.

Southern California Edison
Friendly Field Engineer
909-555-5555
Friendly.engineer@sce.com

Return to:

Southern California Edison
Friendly Field Engineer
909-555-5555
Friendly.engineer@sce.com

City / Authority Having Jurisdiction:_____

SCE Project #:_____

I, _____, hereby certify that:

1. The existing customer switchgear has been altered to allow the interconnection of the generating facility to the source side of the customer's main breaker; and

2. The altered customer switchgear continues to meet UL certification requirements or that the modified equipment has been recertified for its new configuration.

Name & Title:_____ Signature:_____ Date: _____

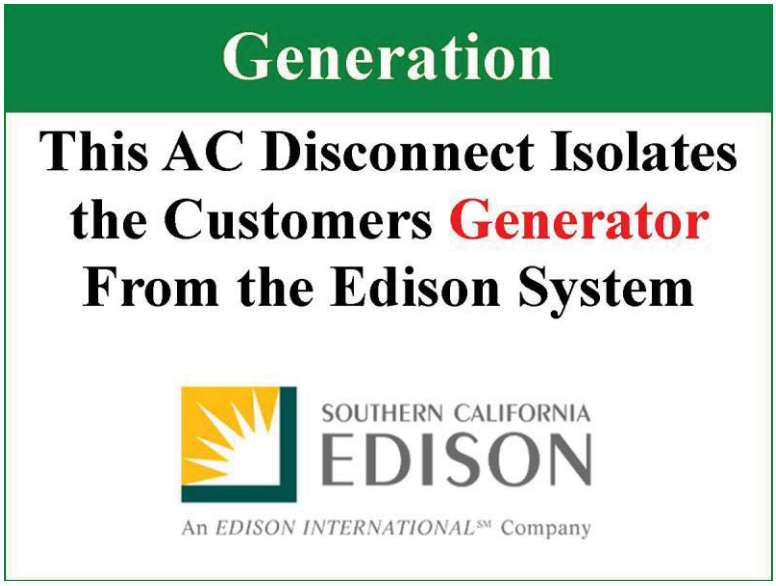
Appendix F: Vendor Decal instructions

Once you have identified a vendor to make each type of decal: Send this template to have a vendor make the decals to be installed on your generation project. This is the actual size of the decals.

For decals that have to be placed on the customer's panel:

Small Generator Labels 3" x 4"
Forms: 15-40-A
Specs: 3" x 4", yellow, green, red and black on 3M premium vinyl with 3M #3980 clear coat and scored backing

For decals that have to be placed on AC Disconnects



Small Generator Labels 3" x 4"
Forms: 15-43-A
Specs: 3" x 4", yellow, green, red and black on 3M premium vinyl with 3M #3980 clear coat and scored backing

Once the decals are made, please send a sample set to:

Attn: SCE Field Engineering Support

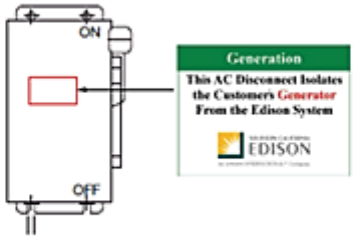
2885 West Foothill Blvd.

Rialto, CA 92376

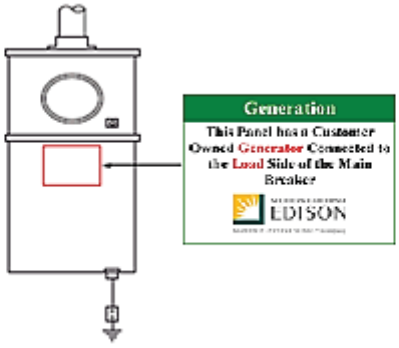
Please also provide your contact information and your vendor information.

Once the decals are approved by SCE, please install them as per the diagrams below for each project as part of your application package.

Example of Labeling Practice for an AC Isolation Disconnect with Generation



Example of Labeling Practice for a Residential Meter Panel with Generation



NOTE: The examples above are intended to portray typical customer equipment. If you have any questions or concerns about signage placement, contact the Field Engineer directly.